For engineers who design and manage the power and plant services

Power

MAY 1959 • ONE DOLLAR

A McGRAW-HILL PUBLICATION

New goals for Industrial Lighting

a *TD* report • 51

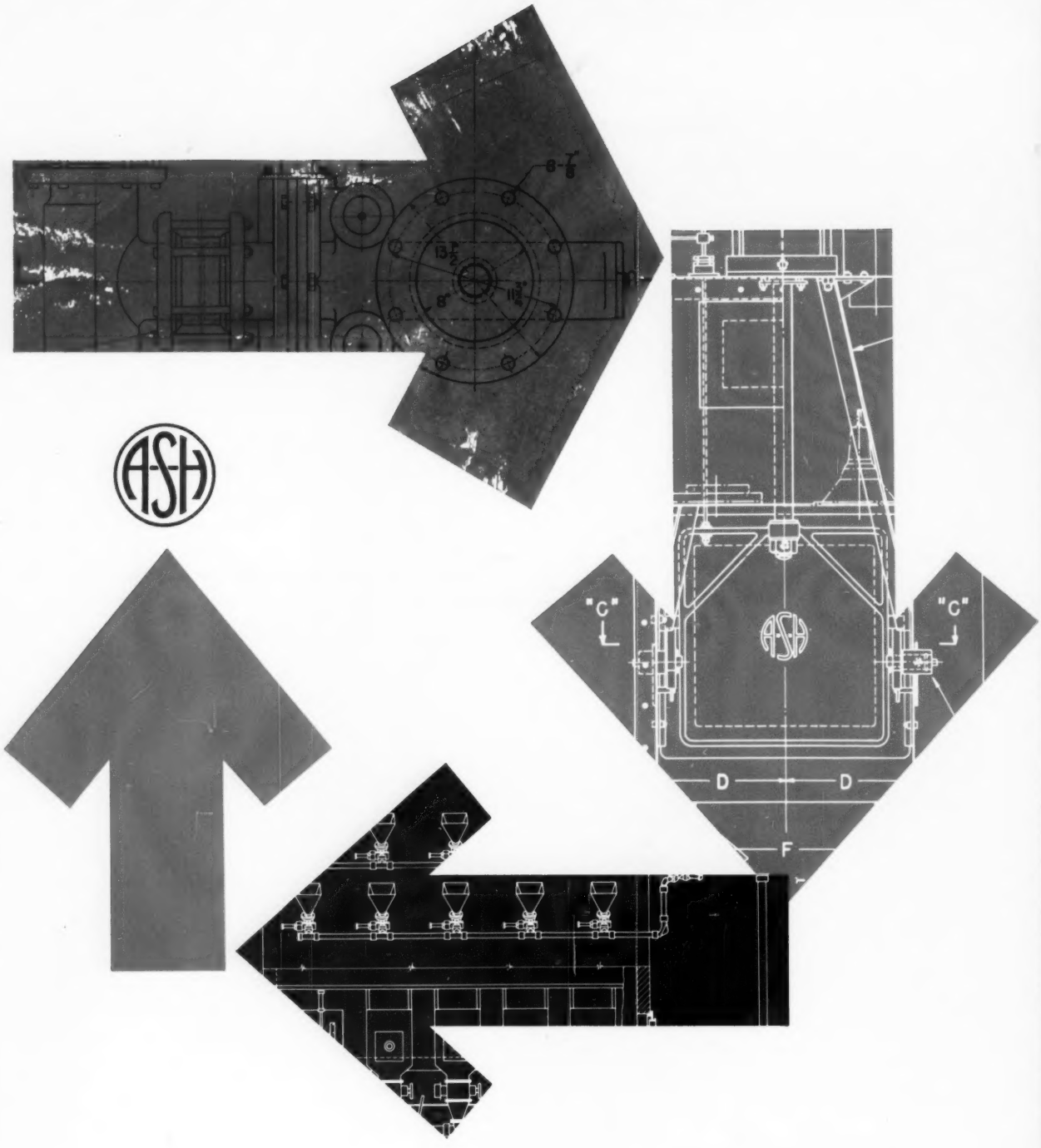
How to select desuperheaters 60

Control breakthrough at Little Gypsy 64

Know how to cope with plant politics? 195

H-t cooling boosts i-c engine performance 202

Electrical maintenance for the growing plant 206



ALLEN-SHERMAN-HOFF

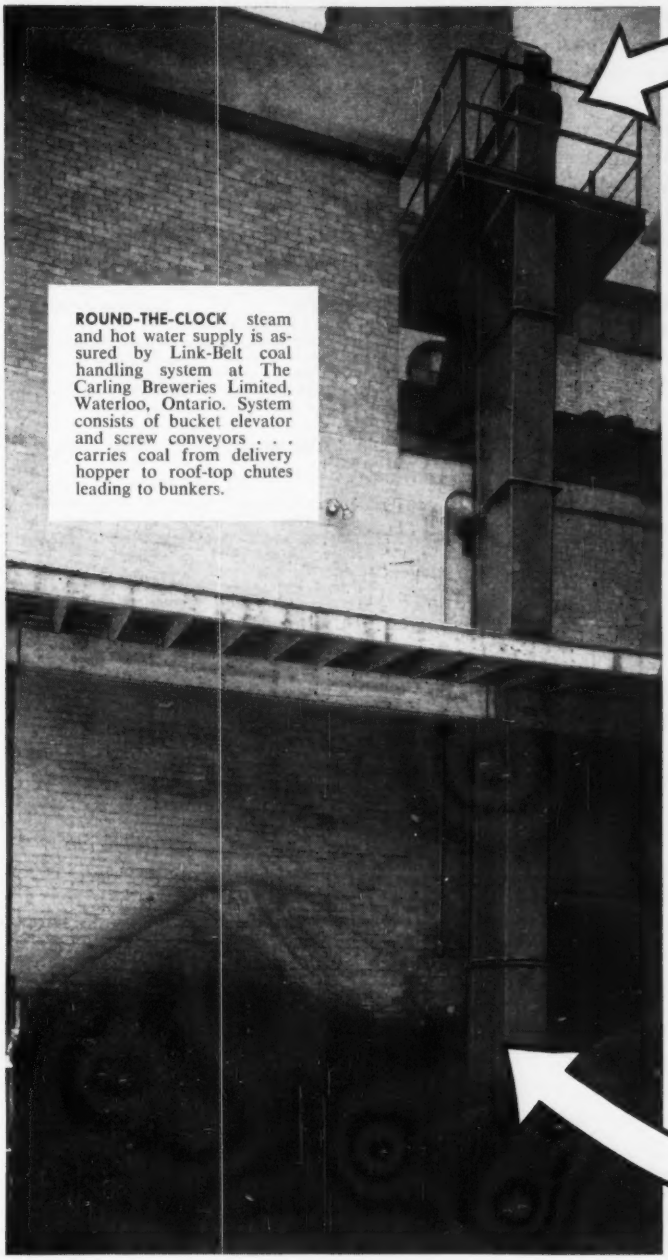
10,000 drawings of ash handling systems and components are catalogued and deposited in the vaults of our Engineering Department. They represent actual and proposed systems for utility and industrial power plants in every part of the world.

While the engineering and experience these drawings represent could not be purchased at any price, they are at your immediate disposal. Write, wire or phone THE ALLEN-SHERMAN-HOFF COMPANY, 259 East Lancaster Ave., Wynnewood, Pa. Cable: Ash-Wynnewood.

For more facts circle 201 on Reader Service card, p 97

Characteristic of efficient coal handling, this LINK-BELT system is

simplicity itself



ROUND-THE-CLOCK steam and hot water supply is assured by Link-Belt coal handling system at The Carling Breweries Limited, Waterloo, Ontario. System consists of bucket elevator and screw conveyors . . . carries coal from delivery hopper to roof-top chutes leading to bunkers.

LINK-BELT SCREW CONVEYORS on roof of boiler house. Conveyor in foreground discharges to chutes which feed boiler bunkers.

Long engineering background and broad equipment line produce low cost handling

Coal handling at the Waterloo, Ontario plant of The Carling Breweries Limited is typical of Link-Belt's ability to custom-tailor systems to the special needs of any size plant, from large central power stations to small boiler houses.

Whether received by boat, rail or truck . . . inside or outside storage—Link-Belt engineers can bring a vast store of experience to focus on your particular problems. And this experience plus Link-Belt's complete line of equipment assures low-cost-per-ton answers.

If desired, Link-Belt will work with you and your consultants from planning through erection of your system. Call your nearest Link-Belt office. Send for Book 2410.

LINK-BELT HELICOID SCREW FEEDER transfers coal from truck hopper to boot of bucket elevator. Elevator moves coal to screw conveyors on roof.

LINK-BELT

COAL HANDLING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 14,910

speaking of **Power**

Modernization of obsolete manufacturing plants and equipment is slated to take 66% of total capital expenditures planned by manufacturing companies for the years 1959-1962, a new peak for modernization spending. During 1959 business plans to invest 7% more than spent in '58 for plant and equipment and to further increase capital spending in 1960. Other facets of the latest McGraw-Hill Survey of business plans for 1959-1962 include projected sales, employment and research and development.

The Survey found U.S. manufacturing companies operating at an average of 80% capacity at the end of '58. Plans are under way to increase capacity during the next four years, but at a more modest rate than in previous years. Another encouraging note came from the expected sales figures for manufacturing companies: Sales are predicted to be 9% higher in 1959 and should show an additional increase of 18% by 1962. Employment among manufacturers is expected to rise more modestly: about 3% this year and 8% between 1959 and 1962.

Research and development showed a healthy 12% increase during 1958. Faced with a recession in sales and profits, U.S. business wisely held firm on earlier plans to increase dollars spent for R&D. What did this mean in dollars? In 1958 the bill tallied $8.2 billion, which was a new record and 12% over the 1957 total. Last spring, business reported to McGraw-Hill that it expected to spend $8.3 billion for R&D in 1958.

To the power man this healthy business prospect indicates, among other things, a better awareness on the part of top management of the important role modernization plays in ultimate economic success. It will mean that many long-delayed plans for updating the power services will come to pass. It also promises an improvement in the power-service products available to you, an ultimate reflection of the increased activity in R&D.

Lou Rowley

L N ROWLEY — ***Publisher and Editor***

B G A SKROTZKI — *Design and Application*
S M ELONKA — *Maintenance and Management*
J J O'CONNOR — *Managing Editor*
R C BELLAS — *Associate Editor*
R H MARKS — *Associate Editor*
N PEACH — *Associate Editor*
J W FOLLANSBEE — *Assistant Editor*
A P SOMMER — *Assistant Editor*
L E STEWART — *Assistant Editor*
C F MARSCHALEK — *Art Editor*
F A ANNETT — *Contributing Editor*

DOMESTIC NEWS BUREAU: Atlanta, Chicago, Cleveland, Dallas, Detroit, Los Angeles, San Francisco, Seattle, Washington, D. C.
WORLD NEWS OFFICES: Beirut, Bonn, Caracas, London, Mexico City, Moscow, Paris, Tokyo

CLARK BOUGHTON — *Sales Manager*

DISTRICT MANAGERS

ATLANTA 3, GA. — W O Crank, 801 Rhodes-Haverty Building, Walnut 5778
BOSTON 16, MASS. — D L Kates, 350 Park Square Building, Hubbard 2-7160
CHICAGO 11, ILL. — L W Romigh and G L Crane, 520 North Michigan Avenue, Mohawk 4-5800
CLEVELAND 13, OHIO — R E Heisserman, 1164 Illuminating Building, Superior 1-7000
DALLAS 1, TEXAS — R T Wood, The Vaughn Building, Prospect 5064
DENVER 2, COLO. — J W Patten, U. S. National Bank Building, 1740 Broadway, Alpine 5-2981
DETROIT 26, MICH. — L W Romigh, 856 Penobscot Building, Woodward 2-1793
LOS ANGELES 17, CALIF. — R H Antles, 1125 West Sixth Street, Huntley 2-5450
NEW YORK 36, N. Y. — G W Simpson and D L Kates 500 Fifth Avenue, Oxford 5-5959
PHILADELPHIA 3, PA. — C R Long, Six Penn Center Plaza, Locust 8-4330
PITTSBURGH 22, PA. — R E Heisserman, 1111 Oliver Building, Express 1-1314
ST. LOUIS 8, MO. — G L Crane, Continental Building, 3615 Olive Street, Jefferson 5-4867
SAN FRANCISCO 4, CALIF. — R C Alcorn, 68 Post Street, Douglas 2-4600
LONDON E.C. 4, ENGLAND — E E Schirmer, McGraw-Hill House, 95 Farringdon Street
FRANKFURT-MAIN, GERMANY—M R Zeynel, McGraw-Hill Publishing Co, Inc, 85, Westendstrasse

W K PONDER — *Circulation Manager*

Print order this issue: 49,814

POWER (with which are consolidated *Science and Industry, The Engineer Review, The Engineer, The Stationary Engineer* and *Operating Engineer*) is published monthly by McGraw-Hill Publishing Company, Inc, James H McGraw (1860-1948), Founder. PUBLICATION OFFICE: McGRAW-HILL BUILDING, 330 W 42nd St, New York 36, N. Y. See box, right, for directions regarding subscriptions or change of address.

EXECUTIVE, EDITORIAL, CIRCULATION and ADVERTISING OFFICES: 330 W 42nd St, New York 36, N. Y. Officers of the McGraw-Hill Publishing Company, Inc: Donald C McGraw, President; Joseph A Gerardi, Executive Vice-President; L Keith Goodrich, Vice-President and Treasurer; John J Cooke, Secretary. Officers of the Publications Division: Nelson L Bond, President; Shelton Fisher, Senior Vice-President; Ralph B Smith, Vice-President and Editorial Director; Joseph H Allen, Vice-President and Director of Advertising Sales; A R Venezian, Vice-President and Circulation Coordinator.

Subscriptions are solicited only from executives, engineers and supervisory personnel engaged in design, operation and maintenance of the power and plant services in utilities, consulting and contracting firms, industrial and service plants. Position and company connection must be indicated on subscription orders. Send to address shown in box, right.

United States subscription rate for individuals in the field of the publication $5.00 per year, single copies $1.00, unless otherwise indicated. Canada; $7.00 for one year. Foreign; $15.00 for one year. Second-class

For more facts circle 204 on Reader Service card, p 97

In Power this month

MAY 1959 • VOL. 103 • NO. 5 • 77TH YEAR

Editorial: Planned purchases pay off ____ 47

DESIGN AND EQUIPMENT APPLICATION

A *TD* report: New goals for industrial lighting ____ 51
Operating problems help guide feedwater heater designs ____ 56
Tips on evaluating direct-contact methods of desuperheating ____ 60
Control breakthrough brings about first fully automatic power plant ____ 64
Use these charts to find film coefficients quickly ____ 66
How mechanical-drive turbines are governed ____ 68
Here's help in finding heat loss through insulation ____ 71

DEPARTMENTS

Nuclear notes: News briefs on the latest developments ____ 76
Comment: Two pages reserved for readers' remarks ____ 78
Data sheet: Equivalent fuel-oil viscosities ____ 82
Technical briefs: Digests of latest engineering papers for busy power men ____ 86
New literature: Yours simply for mailing postage-free Reader Service card ____ 98
Equipment design of the month: A new centrifugal-action steam generator ____ 110
Plant equipment news: Your information center for new products and materials ____ 112
Thermo refresher: Cycle intercooling, reheating ups gas-turbine performance ____ 144
Marmaduke Surfaceblow tells of a fuel-saving bonus scheme that backfired ____ 150
Powerscope: A selective look at this month's power-field happenings ____ 160
Reports from the field ____ 162 *Calendar of events* ____ 166
Appointments ____ 180 *Engineers' bookshelf* ____ 186
George *Edwards* faces a flood caused by low water ____ 192

PLANT MAINTENANCE AND MANAGEMENT

How you can lick plant politics ____ 195
Operators' notebook: Now you can *weld* copper to stainless or mild steel ____ 198
What you should know about pilot-operated solenoid valves ____ 200
H-t cooling utilizes waste heat, boosts i-c engine performance ____ 202
Here's how you can fight fretting corrosion in sheaves ____ 204
Six experts tell how they tackle electrical maintenance ____ 206
Plant electrical fact file: Stator-winding connections for multispeed motors ____ 208
Plant problems: Here's how Power readers solve them ____ 210
Practical ideas to keep your plant running at peak efficiency ____ 214

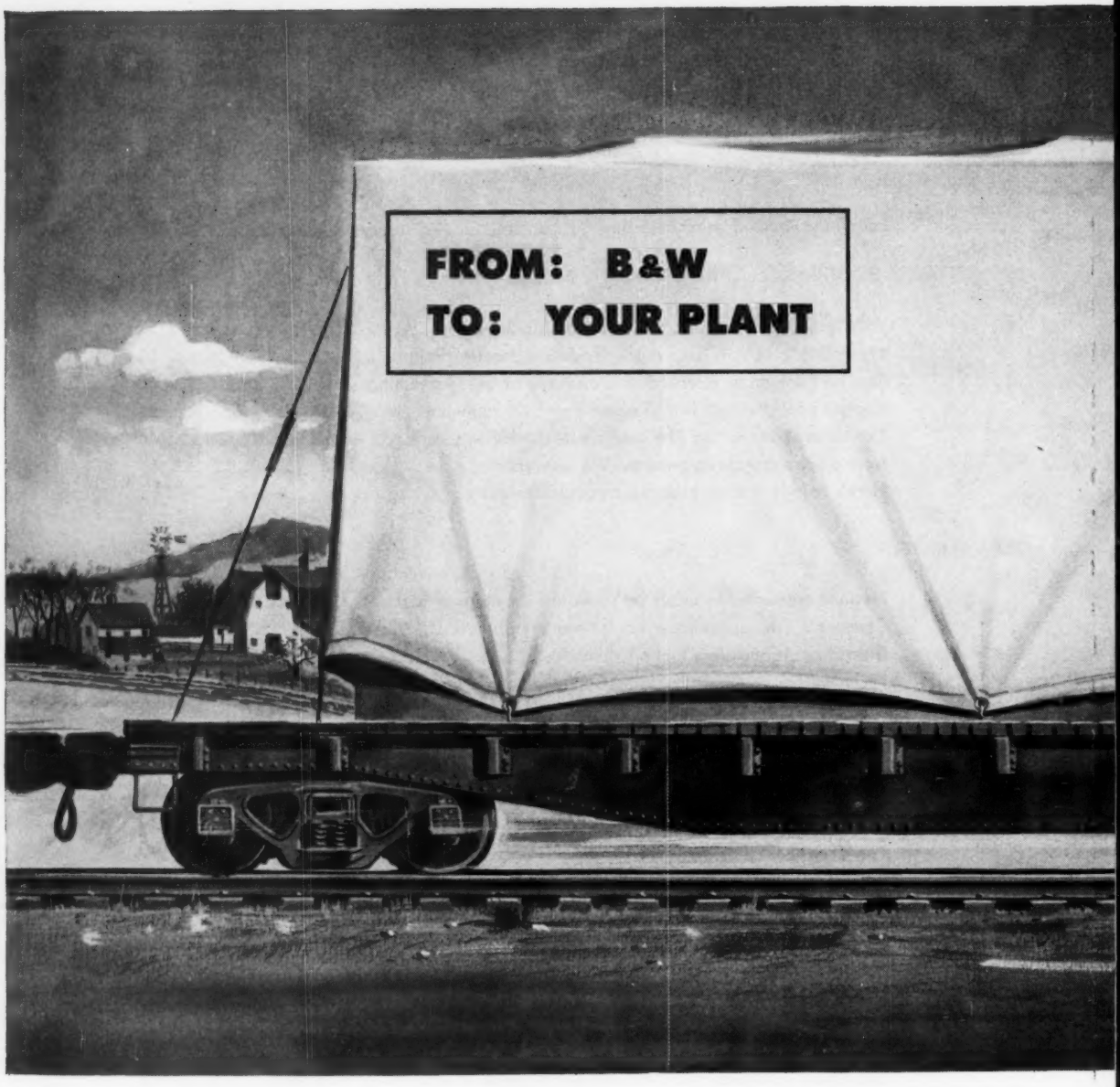
postage paid at New York, N. Y. Printed in U.S.A. Title registered in U.S. Patent Office. ©. Copyrighted 1959 McGraw-Hill Publishing Company, Inc, all rights reserved.

UNCONDITIONAL GUARANTEE: Our primary aim is to provide subscribers with a useful and valuable publication. Your comments and suggestions for improvement are encouraged and will be most welcome. The publisher, upon written request from any subscriber to our New York office, agrees to refund the part of the subscription price applying to copies not yet mailed.

Power articles are indexed in both the *Industrial Arts Index* and the *Engineering Index*. POWER publishes its own annual index, obtainable on request to the Editor. Notice of availability appears in POWER.

SUBSCRIBERS: Send subscription correspondence and change of address to Fulfillment Manager, POWER, 330 W 42nd St, New York 36, N. Y. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any (Official Post Office request). If possible, enclose an address label from a recent issue of the magazine. Since copies are addressed one to two issues in advance, please allow one month for change of address to become effective.

Postmaster: Send form 3579 to POWER, 330 W 42nd St, N. Y. 36, N. Y.



Do you need from 60,000 to 100,000 pounds of steam per hour? Have it delivered to your plant in one space-saving, dependable and economical package—the B&W Type FO Package Boiler for oil and gas firing.

What does the B&W Type FO Package Boiler offer you?

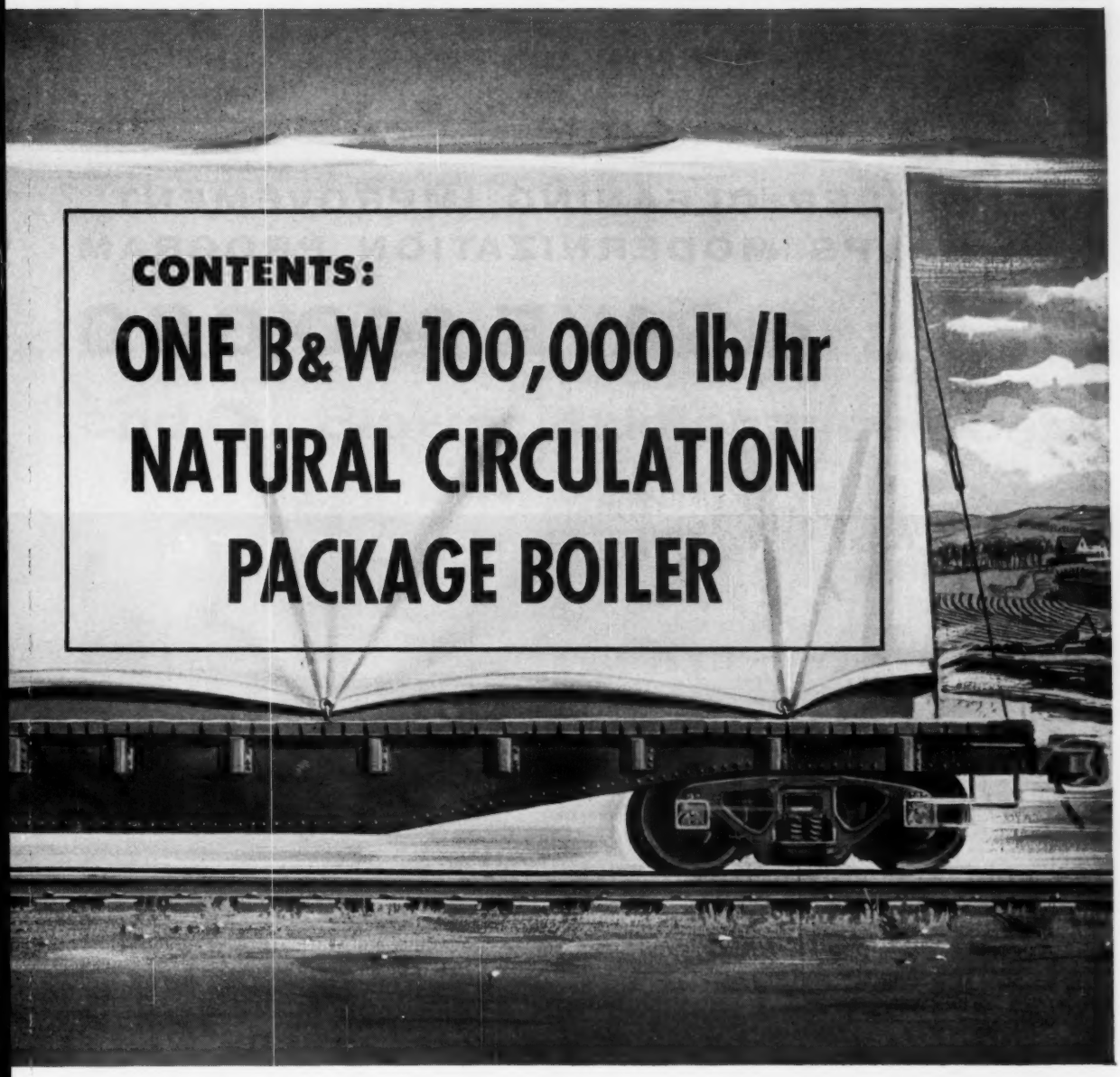
Superior Performance—Capacity up to 100,000 lb/hr. Steam pressures from 250 to 775 psi. Temperatures to 750 F. The B&W Type FO Package Boiler gives you ample furnace volume and area in a really compact unit. It's the result of B&W's years of designing for reliable high capacity in small space for the Navy and Merchant Marine.

Dependability—The entire furnace is water-cooled. That means less trouble; low maintenance. Also, the drainable superheater allows fast start-up and safe, rapid storage.

Easy Cleaning—The tubes are arranged for effective soot blower cleaning.

Natural Circulation—It's the best way to bring you maximum reliability, simplicity, and minimum maintenance at low cost.

Clean, Dry Steam—B&W Cyclone Steam Separators and Scrubbers guarantee minimum carry-



over, maximum circulation. Thousands of boiler installations have proved the superiority of Cyclone Separators.

Easy Installation—Remove it from the flatcar, make a few connections, start it up.

Three words sum up the advantages of the new B&W Type FO Package Boiler—*economy, convenience, quality.*

Get the complete details on the natural circulation, oil and gas fired B&W Type FO Package Boiler, from your local B&W Sales Engineer. Or write The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

B&W

THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

G-913 1B

For more facts circle 205 on Reader Service card, p 97

AT F.M. TAIT STATION, DAYTON POWER & LIGHT CO.

BOILER CLEANING IMPROVEMENT HELPS MODERNIZATION PROGRAM

SAVE $40,000

DIAMOND BLOWERS and AUTOMATIC

Three of the Diamond Model IK Long Retracting Blowers installed to replace manually operated rotary blowers. Electric motor driven, they are controlled by the Automatic Sequential Panel. Air is used as the blowing medium. Rotary elements were retained in cooler locations and motorized for automatic operation and are also controlled by the Automatic Sequential Panel.

In the continuous struggle to cut operating costs, the Dayton Power & Light Co. has found a very useful tool in "Boiler Cleaning Modernization."

By applying the latest soot blowing equipment to four of their boilers at the F. M. Tait Station, together with other features of the modernization program, the Dayton Power & Light Co. was able to reduce the operating costs on these boilers by some $40,000 per year and also cut blower maintenance costs.

On the first boiler that had its cleaning modernized, 17 rotating elements were removed; the remaining seven blowers of this type were electrified for automatic control. The cleaning equipment added consisted of five Long Retracting Blowers and six Short Retracting Blowers. All blowers are automatically controlled by a Diamond Selectromatic Panel.

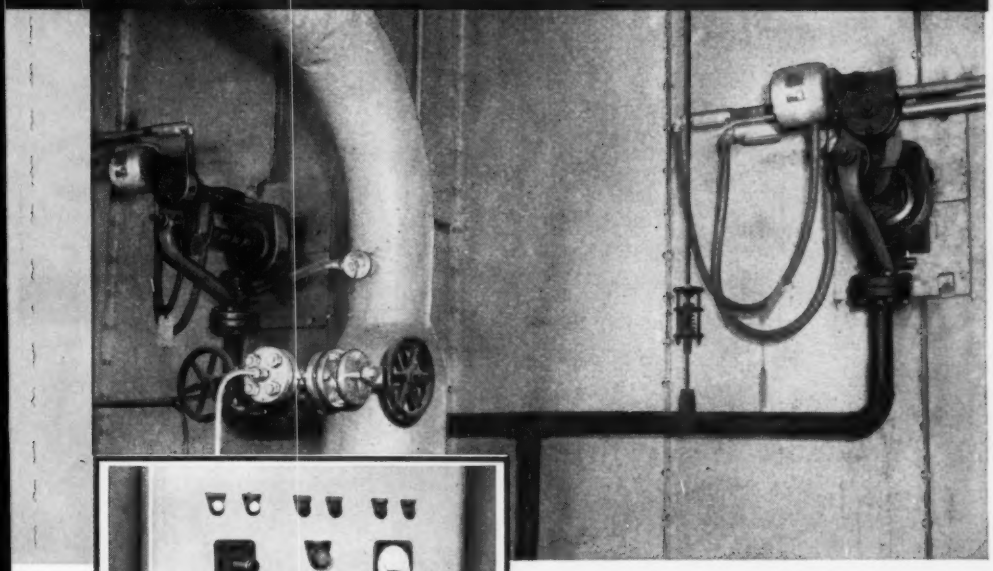
This is one of many examples of the savings possible by improvements now available in Diamond Blowers and Automatic Sequential Control. Over the years Diamond has engaged in continuous aggressive research in boiler cleaning. This research has paid off in improvements that save you money and improve your operation.

Let us make a study of your boiler cleaning . . . perhaps similar savings can be suggested.

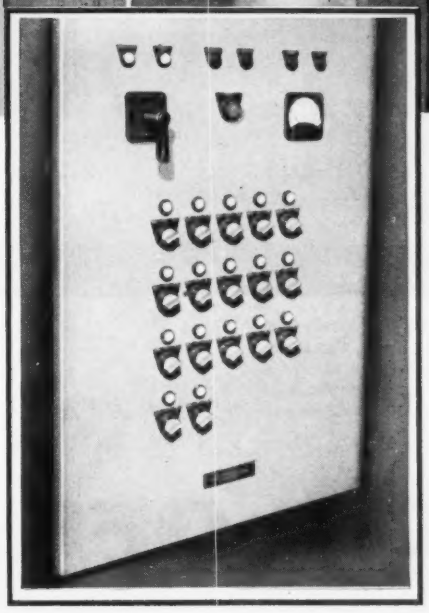
Per Year in Operation

and Cut Blower Maintenance Costs

SEQUENTIAL CONTROL PANEL



Two of the air blowing Model IR short retracting wall blowers with electric automatic operation.



Diamond Automatic Sequential Control Panel installed as part of the modernization program at the F. M. Tait Station. This panel automatically operates each blower in turn until the blowing cycle is complete. Any individual blower may be operated independently by simple turning switches. Cleaning program is set up by switches. Operator starts — thenceforth operation is automatic.

Diamond

DIAMOND POWER SPECIALTY CORP.

LANCASTER, OHIO

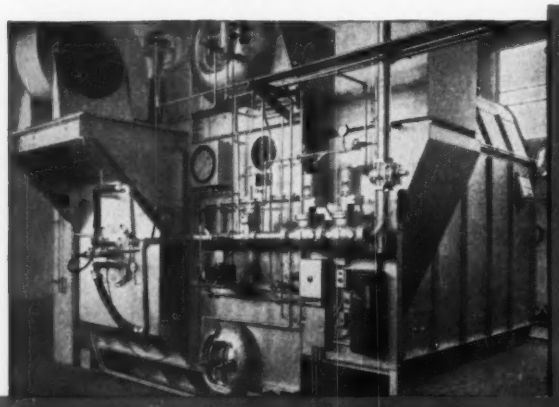
8243

DIAMOND SPECIALTY LIMITED • WINDSOR, ONTARIO

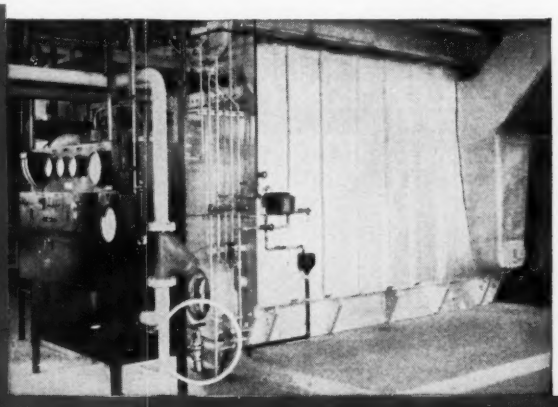
For more facts circle 206 on Reader Service card, p 97

the blow-off valve trend on "package" boilers is

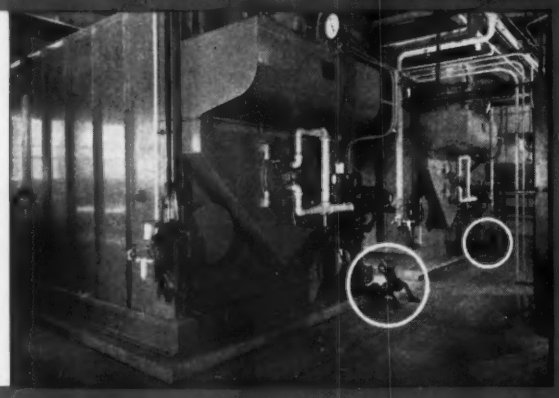
YARWAY SEATLESS



E. KEELER



COMBUSTION ENGINEERING



TITUSVILLE

KEWANEE-SPRINGFIELD

YARWAY® BLOW-OFF

■ More and more leading manufacturers of package-type boilers are featuring Yarway Blow-Off Valves on their units. Many are standardizing on Yarways.

The reason—good blow-off valves help good package boilers *perform better.*

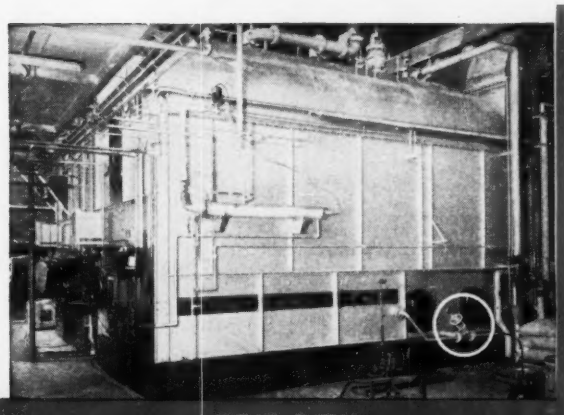
Yarway—known for nearly 50 years for *quality* blow-off valves—offers advanced design, dependable service, and reasonable cost . . . three features attractive to all boiler users.

The Yarway Seatless Blow-Off Valve, with balanced hollow sliding plunger and no seat to score, wear, clog or leak, is the most widely used valve for low and medium pressures.

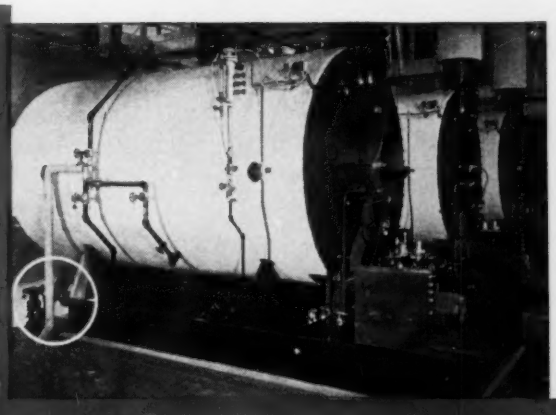
Specify Yarway Seatless Blow-Off Valves on your package boilers. All boiler makers will supply them.

For full description of Yarway Seatless Blow-Off Valves write for Yarway Bulletin B-426.

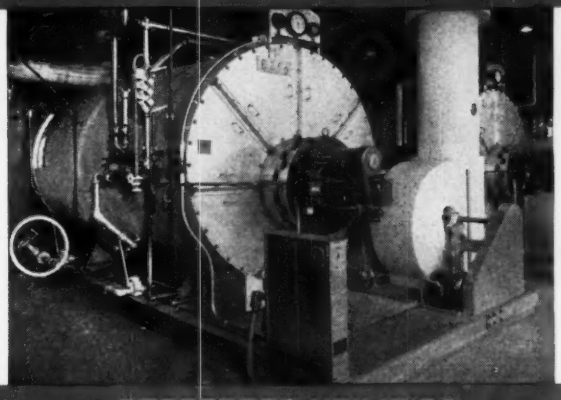
YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES



● ERIE CITY



● CLEAVER-BROOKS

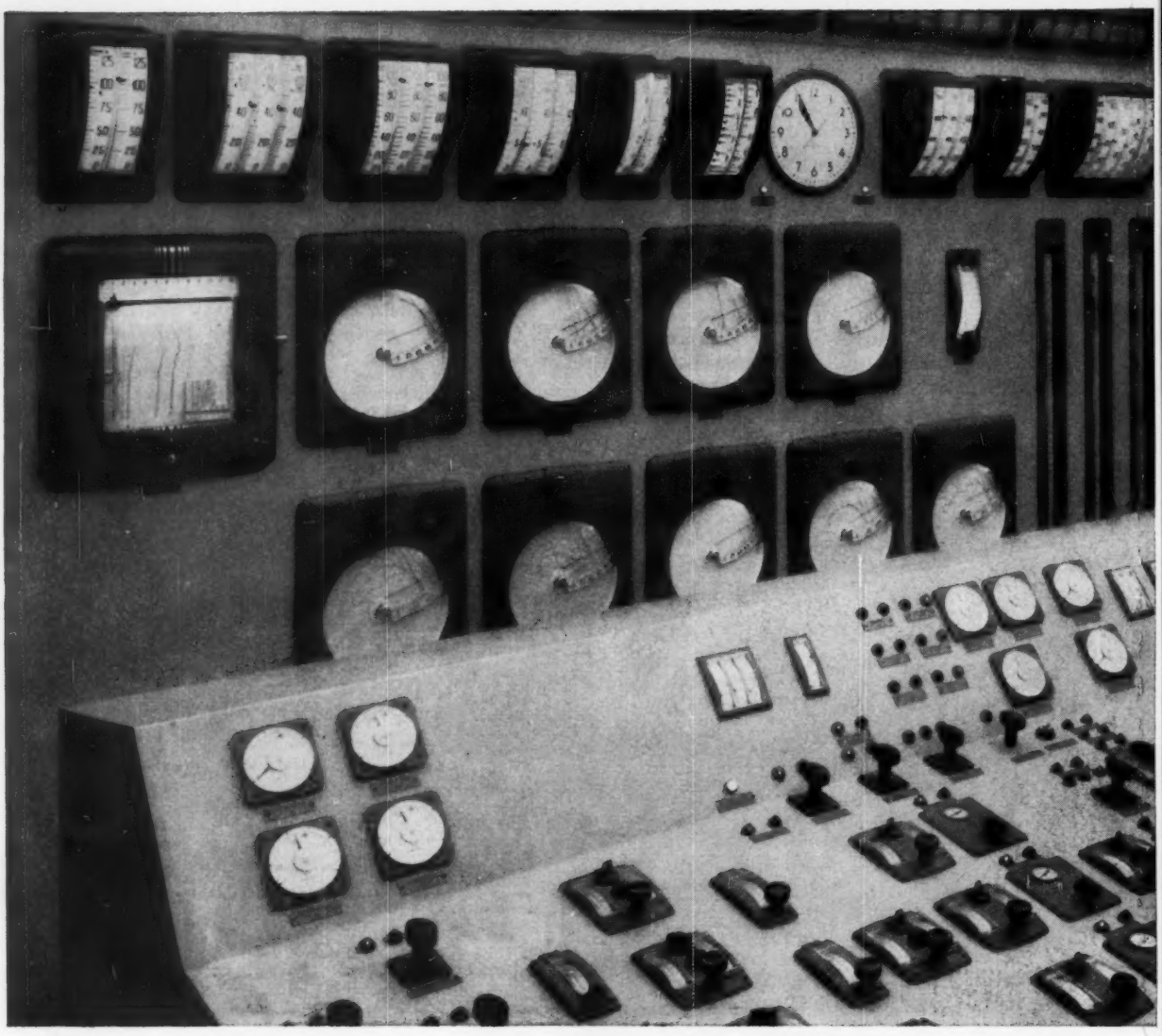


● PREFERRED UTILITIES

● **Yarway Seatless Tandem Blow-Off Valve** (angle-straightway combination) with angle valve sectioned to show balanced sliding plunger design.

● **Yarway Seatless Tandem Blow-Off Valve,** angle-angle combination, straightway-angle or straightway-straightway tandems also available.

VALVES



How Bailey puts, at your finger

Concentrated, here, in one centralized control room are all the meters and controls needed to operate a Cyclone Furnace Boiler. Bailey puts them at your finger tips. Makes operating duties a pleasure. Increases plant efficiency.

Bailey is the choice of virtually all the most efficient plants on the Federal Power Commission's heat rate report. Here's why:

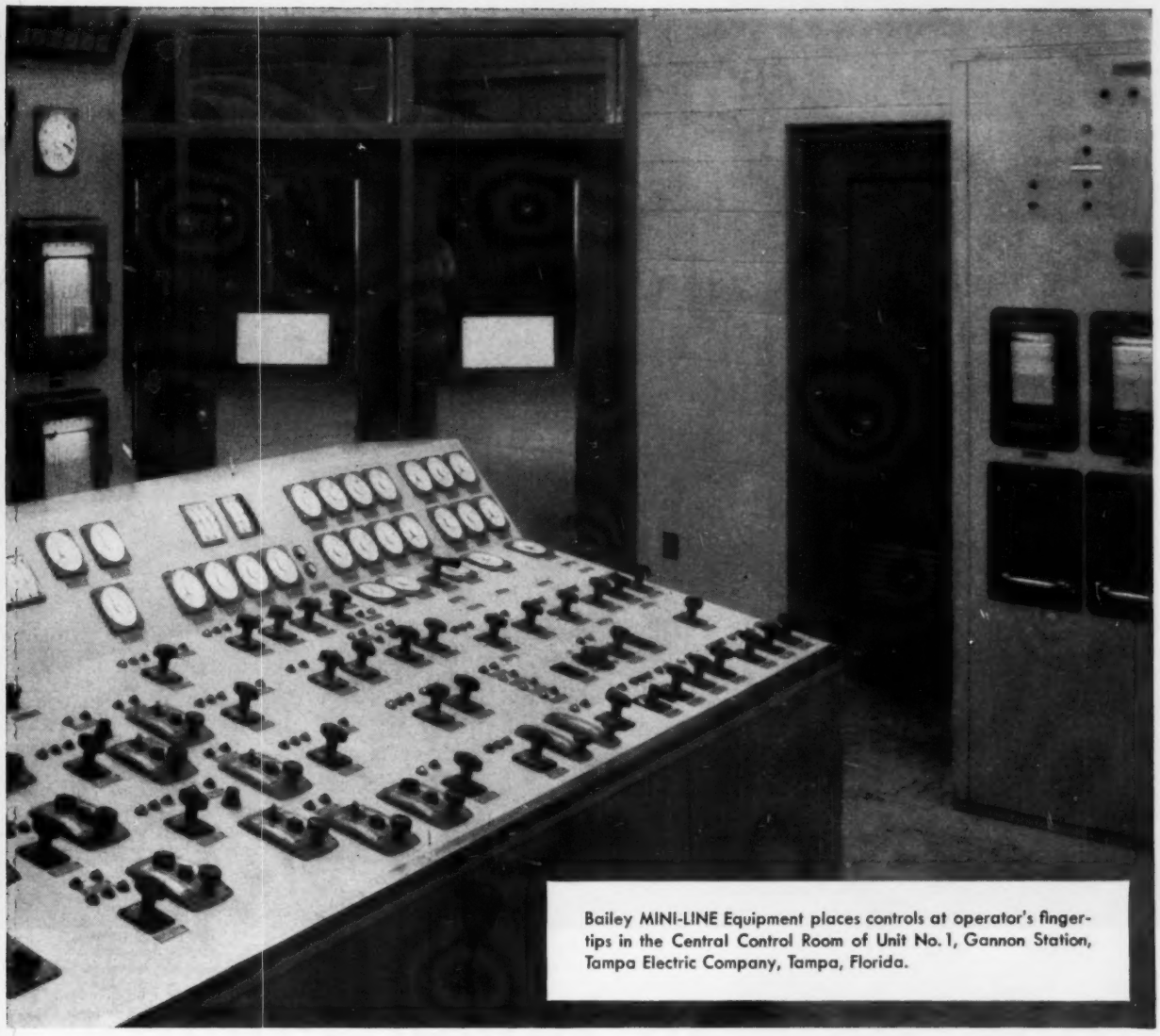
1. A Complete Line of Equipment

You can be sure a Bailey Engineer will offer the right combination of equipment to fit your needs.

Bailey manufactures a complete line of standard, compatible pneumatic and electric metering and control equipment that has proved itself. Thousands of successful installations involving problems of measurement, combustion, and automatic control are your assurance of the best possible system.

2. Experience

Bailey Engineers have been making steam plants work efficiently for more than forty years. Veteran engineer and young engineer alike, the men who



Bailey MINI-LINE Equipment places controls at operator's fingertips in the Central Control Room of Unit No. 1, Gannon Station, Tampa Electric Company, Tampa, Florida.

tips, controls for STEAM PLANTS

represent Bailey, are storehouses of knowledge on measurement and control. They are up-to-the-minute on the latest developments that can be applied to your particular problem.

3. Sales and Service Convenient to You

There's a Bailey District Office or Resident Engineer close to you. Check your phone book for expert engineering counsel on your steam plant control problems.

A137-2

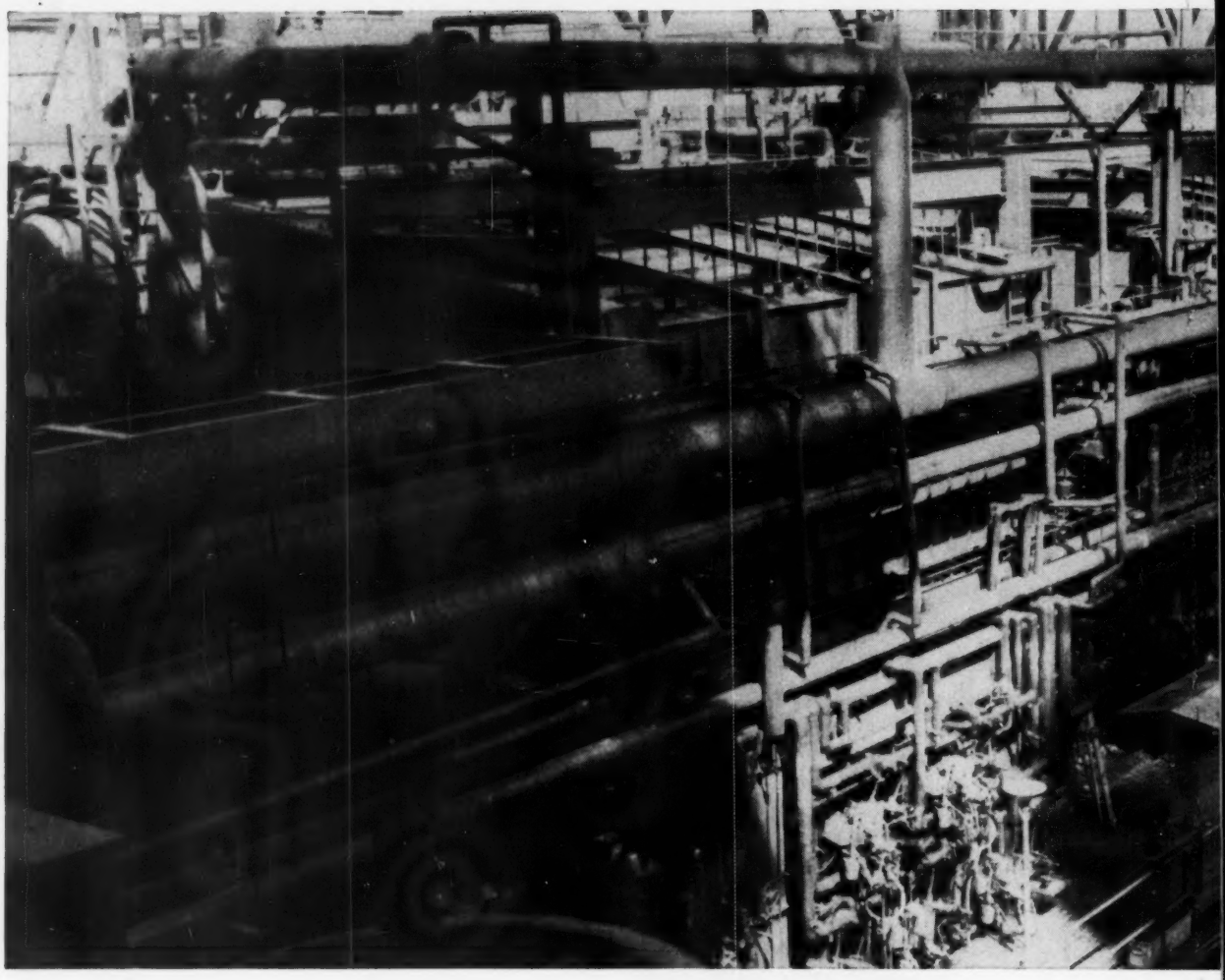
Instruments and controls for power and process

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO

In Canada—Bailey Meter Company Limited, Montreal

For more facts circle 208 on Reader Service card, p 97



Copes-Vulcan boiler control load conditions at Deepwater

In addition to producing power for the Atlantic City Electric Company system, the Deepwater plant delivers steam to an adjacent chemical plant for process use.

To meet the widely fluctuating process demands, Copes-Vulcan controls the two low pressure boilers with precision responsiveness. Each boiler has a maximum continuous rating of 150,000 pounds per hour at 230 psig saturated. The system consists of:

Combustion Control maintaining a constant pressure in the main process steam header by holding steam output from the boiler equal to steam demand.

Copes-Type 3-L Feedwater Control modulated by three control influences—steam flow, feedwater flow and drum water level.

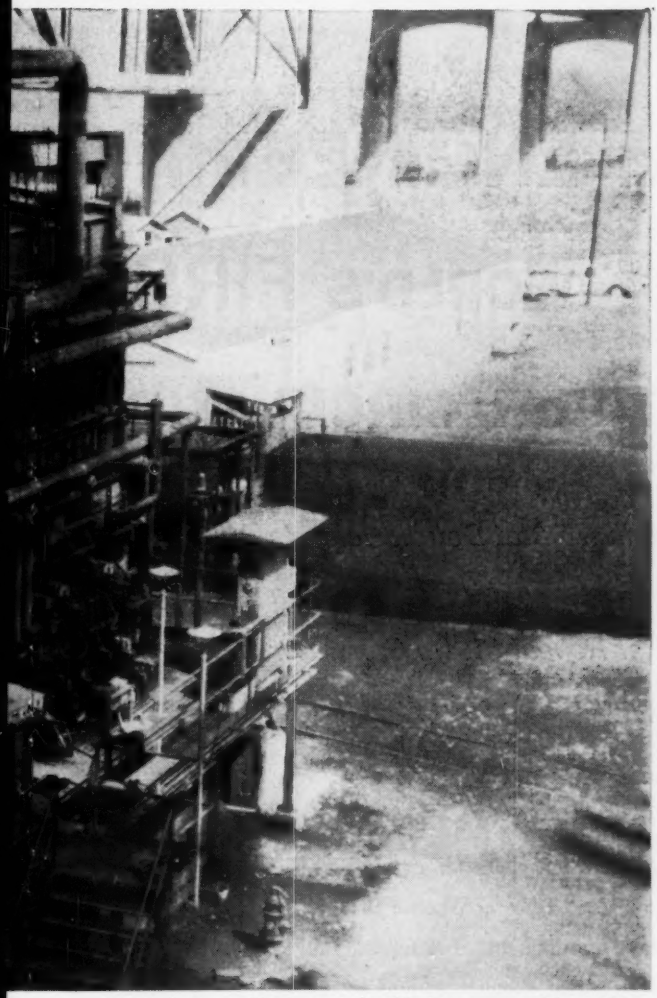
Boiler feed pump recirculation control protecting the boiler feed pumps against overheating on light loads.

Vulcan Rotary Soot Blowers providing positive cleaning over the full blower arc, which may be as much as 360 degrees.

The system controls all equipment with either one or two boilers in service, permits each boiler to carry a different load. Control is automatic through a load range of 20,000 to 200,000 pounds per hour.

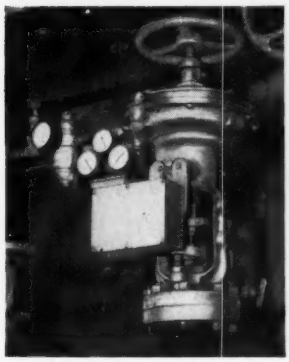
Whether your boiler is large or small, power or process, Copes-Vulcan can provide a unit or an integrated package, custom designed to your requirements. **For details on the Deepwater Station installation, write for Bulletin 1057.**

Copes-Vulcan Division
BLAW-KNOX COMPANY • Erie 4, Pennsylvania



Outside boilers and boiler controls subject to severe weather, with temperatures as low as 10° F. Except for the central control panel and relays and controllers mounted on it, the Copes-Vulcan control system is entirely outdoors.

meets unusual Station

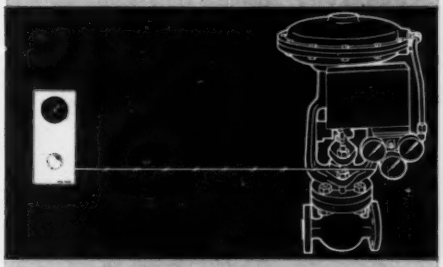


Diaphragm-operated CV-D valve controls the speed of the turbine driving the forced-draft fan. Copes-Vulcan also makes piston-actuated valves. Both types meet pressure standards of 125 to 2500 pounds.

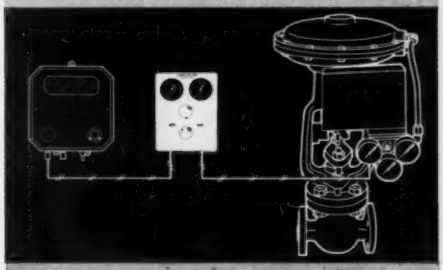
The drive unit with positioner, 4-way valve, power piston and feedback cam controls forced-draft damper. C-V drive units permit remote positioning by automatic or manual pneumatic signals.

C-V NEWS NOTES

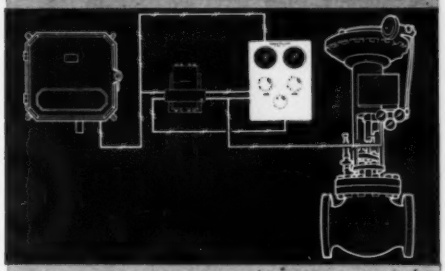
PNEUMATIC CONTROL STATIONS



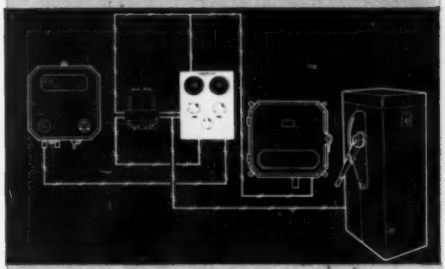
Copes-Vulcan stations offer automatic-to-manual selection without the complication of seal balance. They indicate process-variable, controller and manual loadings. Transfer is "bumpless" without process disturbance. **Shown above: the ML-4 Manual Loading Station.**



AM-4 Selector Station . . . indicates an automatic loading—or originates a manual loading—to the valve, power cylinder or other control element.



AMS-4 Remote Set Station permits manually adjustable set-point loading, or independent manual operation, of the control element.



AMBC-4 Cascade Biasing Station, used with pneumatic stacked diaphragm controllers, permits plus-or-minus biasing of a cascaded set-point to the controller.

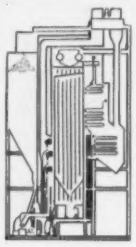
For details about Copes-Vulcan's complete line of pneumatic control stations, write for Bulletin 1031.

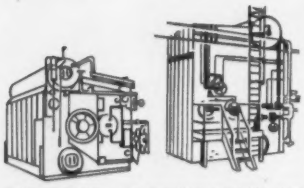
For more facts circle 209 on Reader Service card, p 97

Power Plant Products

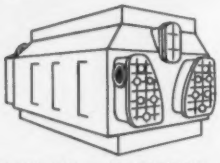
HEAT ENGINEERED BY FW

LARGE STEAM GENERATORS
Designed to meet all requirements for Central Station or Industrial power plants, in single- or twin-furnace designs, with or without reheat or dual circulation.



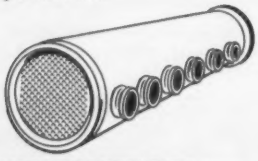


PACKAGED and FIELD-ERECTED BOILERS—Compact, economical, standardized units in capacities from 10,000 to 450,000 lb/hr, oil, gas or pulverized coal fired.

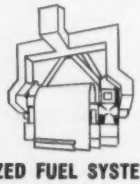


CONDENSERS and HEATERS—Condensers of single or two-pass, double or counter-flow designs. All-welded high and low pressure feed-water heaters.

COOLING TOWERS—Induced draft counter flow towers of all-redwood construction for maximum dependability and long service life.



NUCLEAR COMPONENTS—Heat exchangers, steam generators, pressurizers, reactor vessels, separately-fired superheaters for stationary and marine power plants.



PULVERIZED FUEL SYSTEMS—Completely engineered systems utilizing FW ball mill or MB planetary roll and table pulverizers.

HEAT ENGINEERING

WORLD'S FIRST

NATURAL CIRCULATION

321,500 kw Unit No. 3 at Detroit Edison's River Rouge Power Plant is served by a Foster Wheeler Reheat Steam Generator —one of the most efficient ever built

One of the largest steam generators ever built, this unit was heat engineered by Foster Wheeler to meet the most exacting plant requirements. It supplies Detroit Edison's River Rouge Unit #3 with *two million* pounds of steam per hour at 2450 psi and 1050 F at the superheater outlet. The steam is reheated to 1000 F after it has passed through the initial stages of the turbine.

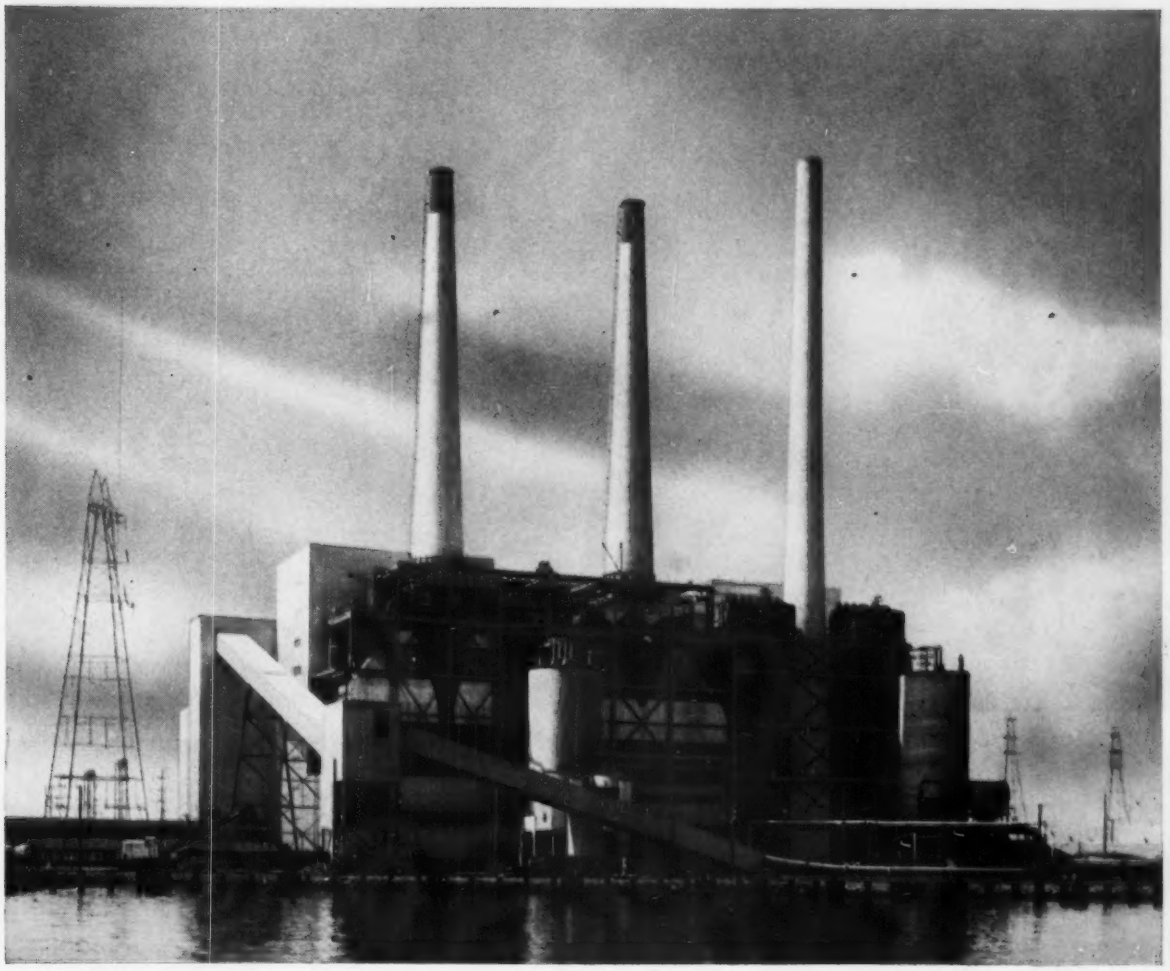
Size alone is not the only measure of this installation. The FW steam generator also helps make Unit #3, with a heat rate of 8685 Btu per kwhr, one of the most economical and efficient ever built, producing a kilowatt hour of electricity from less than ¾ lb of coal.

With more than a half century of specialized experience in heat engineering and steam generation, Foster Wheeler will welcome the opportunity to quote on your steam plant units—for any pressure or any capacity. Foster Wheeler Corporation, 666 Fifth Ave., New York 19, N.Y.

by Foster Wheeler creates

2,000,000 lb/hr

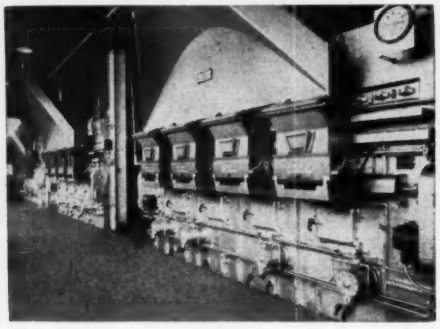
STEAM GENERATOR



FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

At delivery point, coal moves by belt conveyor to bucket elevator which carries it to roof of plant. Here reversible screw conveyor delivers coal either to 430-ton silo or coal bunkers inside plant. Conveyors and silo by Fairfield Engineering Co. Outside storage is under trestle at right.



Looking down firing aisle at three Babcock & Wilcox 75,000 lb/hr boilers. Coal is gravity fed from bunkers through Stock Equipment automatic scales and non-segregating distributors to 4-unit Detroit Rotostokers.

Over coal bunkers. Roof screw conveyor moves coal to chute (left). Coal is then dropped to screw conveyor shown and is carried to any of three 100-ton storage bunkers underneath.

Coal sets pattern for low-cost steam

Fabric finisher burns coal for economy and availability

Modernity is the keynote of the new plant of Carlisle Finishing Co., a division of Cone Mills Corporation, Carlisle, S.C. Advanced planning and up-to-date techniques are evident throughout the company's entire operation.

The power plant, too, reflects this thinking . . . *coal* is used to generate the steam required for heating and processing. Chosen for its economy and availability, coal is burned and handled automatically by the latest equipment for peak efficiency. Also, the interior of this plant—designed by the consulting firm of J. E. Sirrine Co., Greenville, S. C.—has been decorated in cheerful colors to match the cleanliness of operation.

Coal is lowest cost fuel

Today, *when the annual cost of fuel often equals the original cost of the boilers,* you should know that bituminous coal is the lowest cost fuel in most industrial areas. And modern coal-burning equipment gives you 15% to 50% *more* steam per dollar, while automatic operation trims labor costs and eliminates smoke problems. What's more, tremendous coal reserves and mechanized mining procedures assure you a constantly plentiful supply of coal at stable prices.

Technical advisory service

To help you with fuel problems, the Bituminous Coal Institute offers a free technical advisory service. We welcome the opportunity to work with you, your consulting engineers and architects. If you are concerned with steam costs, write to address below or send coupon. Ask also for case histories booklet, complete with data sheets. You'll find them informative.

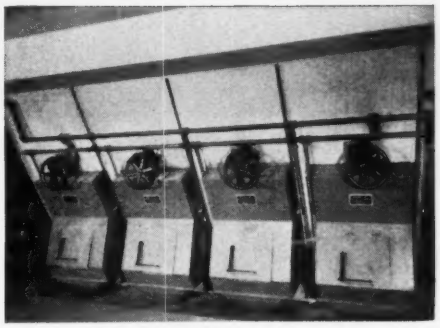
Consult an engineering firm

If you are remodeling or building new heating or power facilities, it will pay you to consult a qualified engineering firm. Such concerns—familiar with the latest in fuel costs and equipment—can effect great savings for you with the efficiency and economy of coal.

BITUMINOUS COAL INSTITUTE

Department P-05, Southern Building, Washington 5, D. C.

See our listing in *Sweet's*



Ash hoppers below furnaces drop ashes into sluice line for disposal. Ash handling system by United Conveyor Co. Fly ash from Western Precipitator collectors is reinjected by high velocity air.

SEND COUPON FOR NEW BCI PUBLICATIONS. Guide Specifications, with complete equipment criteria and boiler room plans:

BITUMINOUS COAL INSTITUTE
Southern Building, Washington 5, D. C. P-05

Gentlemen—please send me:
☐ GS-1 (low-pressure heating plant, screw-type underfeed stoker); ☐ GS-2 (high-pressure heating and/or process plant, ram-type underfeed stoker); ☐ GS-3 (automatic package boiler for heating and process plants). ☐ Case histories on larger plants.

Name .....

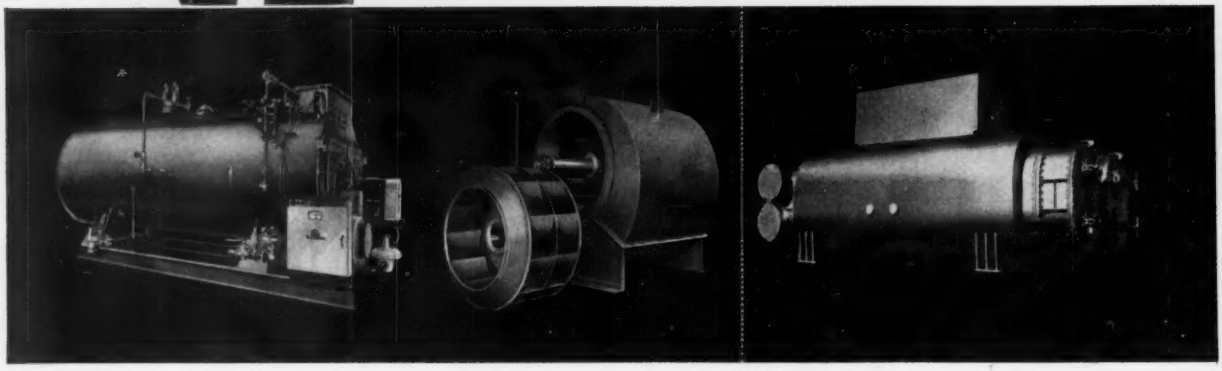
Title .....

Company .....

Address .....

City ..... Zone ..... State .....

Calling in equipment to



Firebox, scotch-type, and package boilers for heat, steam, and industrial power.

Mechanical draft fans for induced and forced draft duty in power plants.

Balanced-flow surface condensers for condensing turbo-generator exhaust steam.

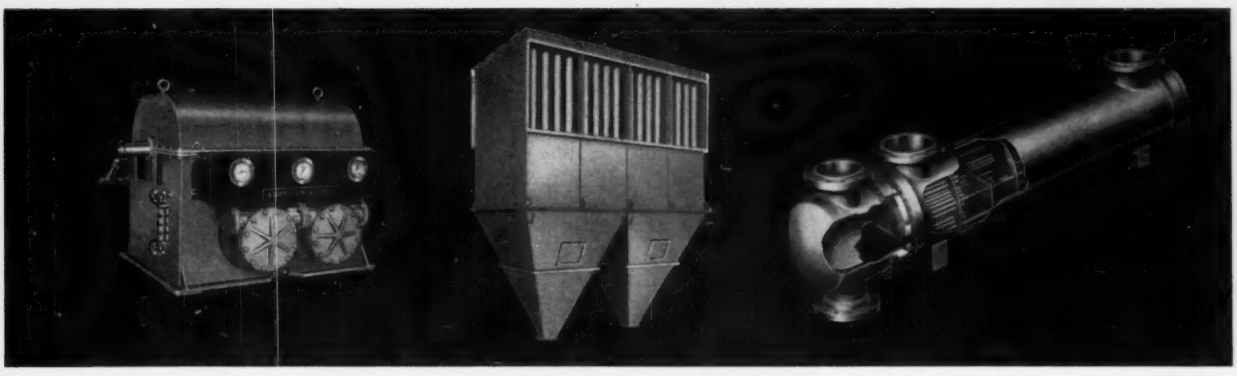
One call for all

representatives discuss specifications?

Be sure one of the representatives you call is from

AMERICAN-Standard Industrial Division

You benefit by discussing equipment-selection with an engineer. American-Standard* Industrial Division is engineer-staffed from brass to branches. Combining three American-Standard divisions – American Blower, Ross Heat Exchanger, Kewanee Boiler – this new organization offers *one-source responsibility* for quality and performance in equipment designed, engineered, and manufactured to work together. There are offices in all principal cities to assist you – from the planning stage on. Contact the one nearest you. American-Standard Industrial Division, Detroit 32, Mich. In Canada: American-Standard Products (Canada) Limited, Toronto, Ontario.



Fluid drives for adjustable-speed control of feed-pump flow and fan volume.

Dust collectors and precipitators for recovering fly ash, eliminating dust.

Standard and engineered heat exchangers and feedwater heaters for every duty.

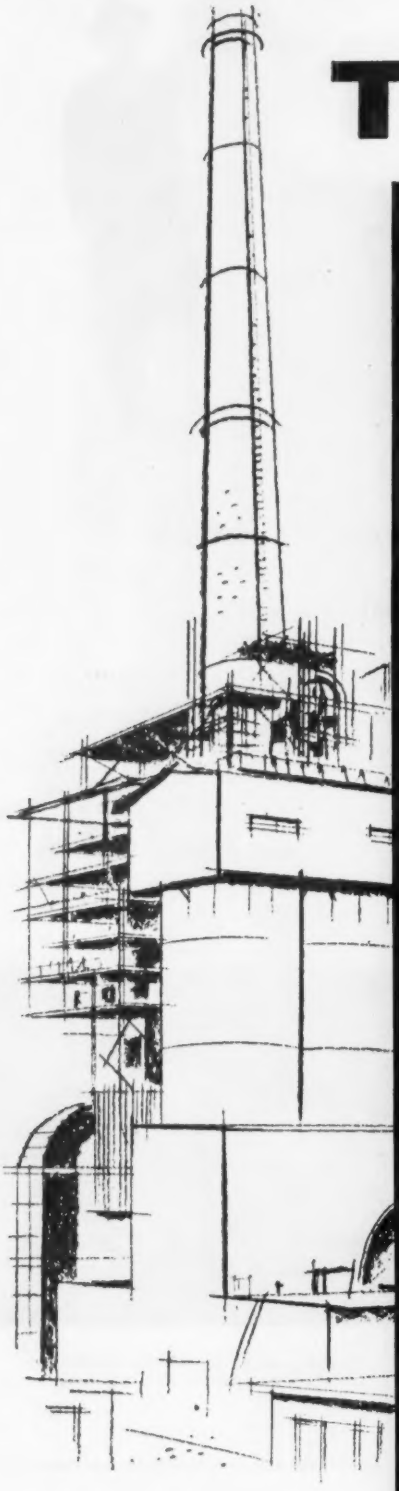
* AMERICAN-Standard and Standard ® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
INDUSTRIAL DIVISION

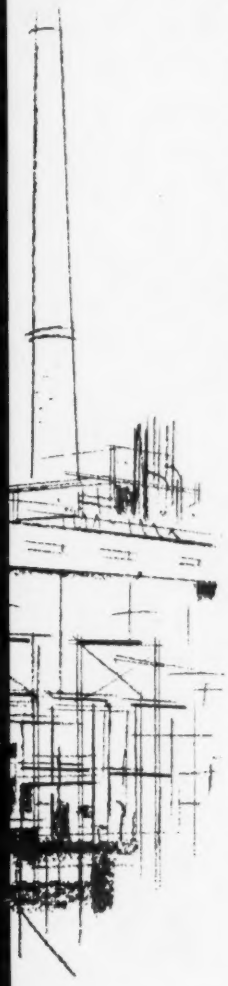
AMERICAN BLOWER PRODUCTS • ROSS PRODUCTS • KEWANEE PRODUCTS

For more facts circle 212 on Reader Service card, p 97

TWO EASY



WAYS TO REDUCE POWER PLANT MAINTENANCE



Now, more than ever, power engineers and maintenance men specify Garlock GUARDIAN* Gaskets and LATTICE-BRAID* Asbestos Packings for safe, long lasting prevention of equipment failure due to high pressures and temperatures. Here are their reasons:

GARLOCK GUARDIAN GASKETS

adjust themselves automatically to maintain positive seal when pressures and temperatures change. No need to retighten bolts periodically. They are constructed of spiral wound strips of V-shaped steel, alternated with layers of asbestos . . . this enables GUARDIAN Gaskets to "spring" back to shape after compression. Also permits using lower bolt loads. Use them on boiler manholes, handholes, tube plates, and pipe flanges, where pressures rise as high as 2500 psi, temperatures to 1050° F. Available in round, oval, square, oblong, diamond, and pear shapes; practically any size and in thicknesses $\frac{1}{8}$", .175", and $\frac{1}{4}$". Write for Catalog AD-104.

GARLOCK LATTICE-BRAID ASBESTOS PACKINGS

require less gland pressure than conventional packings; accordingly, they require adjustment less often. Moreover, LATTICE BRAID outwears all conventional packings thus reducing downtime for repacking. Why? Because LATTICE-BRAID is made of a through-and-through braided construction; each strand passes diagonally through the packing body at a 45° angle, resulting in a unified structure of greater strength. The strands hold together even when the packing is worn far beyond the limits of ordinary braided packings. Next time, repack reciprocating rods or pump shafts with LATTICE-BRAID. See for yourself why so many others use LATTICE-BRAID asbestos packing against steam, oils, gases to 700° F. Write for Catalog AD-131.

Both these products are part of the Garlock 2,000 . . . two thousand different styles of packings, gaskets, and seals for every need. The only complete line . . . that's why you get unbiased recommendations from your local Garlock representative. Call him for further information.

THE GARLOCK PACKING COMPANY, Palmyra, N. Y.

For Prompt Service, contact one of our 30 sales offices and warehouses throughout the U.S. and Canada.

*Garlock Trade Mark

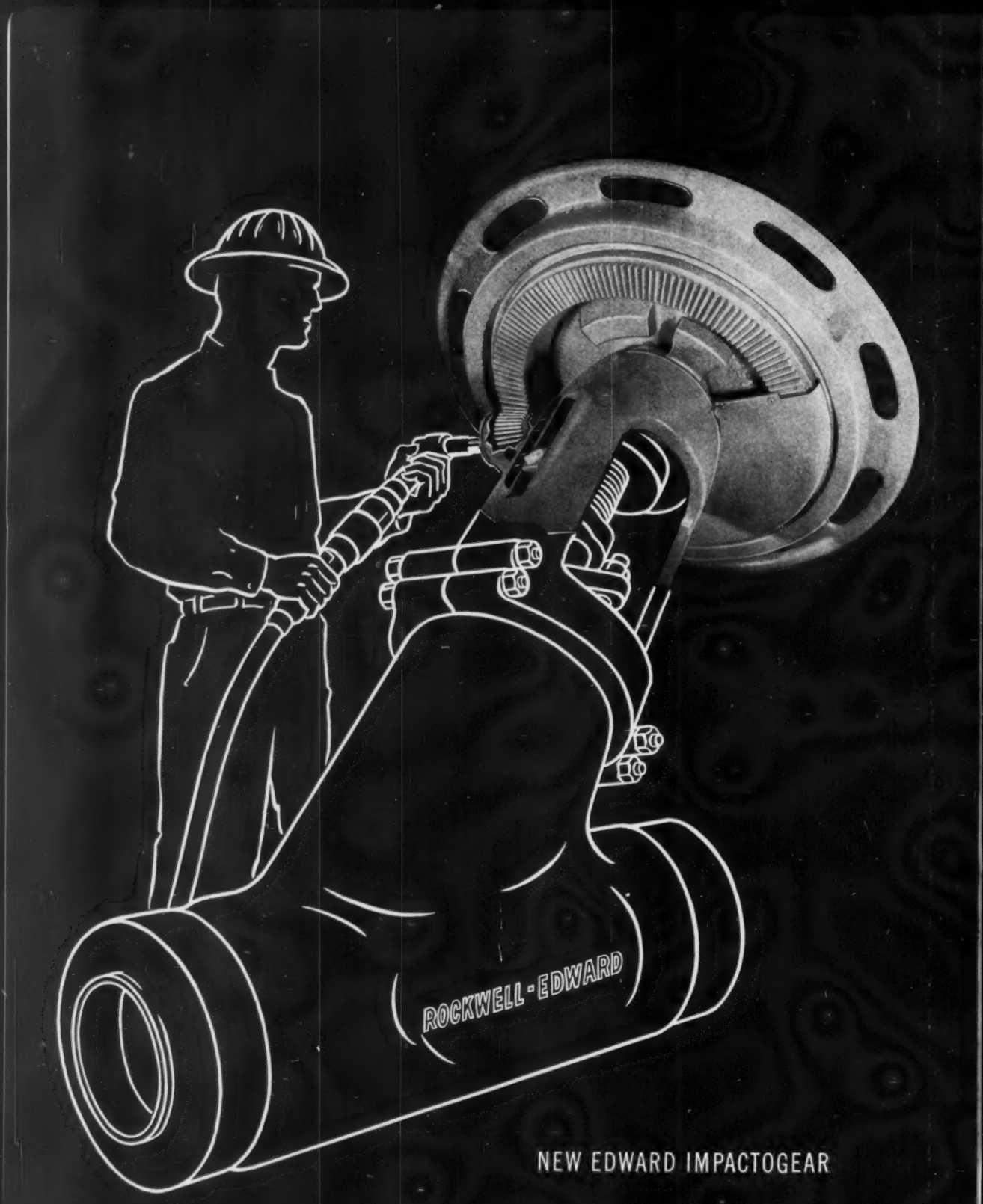
GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Molded and Extruded Rubber, Plastic Products

CANADIAN DIVISION:
The Garlock Packing Company of Canada, Ltd.

PLASTICS DIVISION:
United States Gasket Company

For more facts circle 213 on Reader Service card, p 97



NEW EDWARD IMPACTOGEAR

What's New from Edward Valves

New Products . . . Solutions to Problems . . . Information on Steel Valves from Edward, Long-Time Pioneer in the Field!

How Impactogear* operates high-pressure valves

You no longer need a crew of men to open or close big, high-pressure valves. New Edward Rockwell-built Impactogear makes big-valve operation a quick and easy job.

FAST AND EASY "RUNDOWN"

Your operator simply applies portable air or electric wrench to pinion shaft-end of Impactogear. When power is applied, pinion turns ring gear, which turns handwheel and moves the stem to "closed" position. Impactor* handwheel then gives final tight shut-off with unique "hammer-blow" action. (Tests show it delivers 12 times the closing force of ordinary handwheels—with less effort!) Impactogear works quickly, can operate a 2500-lb 10" valve (for example) in only 2½ minutes. And Impactogear can be fitted to any 8" or larger Edward valve of 900-lb (or higher) pressure class.

IMPACTOGEAR WITH AIR WRENCH

Impactogear utilizes standard portable air or electric wrenches generally available throughout industry. Example below shows how two typical air wrench ratings can be applied:

Wrench Type No. 1—Stall torque 170 ft-lbs: Free speed 225 rpm; Weight 12 lbs

For 12" and 14" 2500 lb. valves, operating pressures to 3500 psi

For 10" 2500 lb valves, all allowable operating pressures

For 10", 12" and 14" 1500 lb valves, all allowable operating pressures

For 12" and 14" 900 lb valves, all allowable operating pressures

Wrench Type No. 2—Stall torque 200 ft-lbs: Free speed 300 rpm; Weight 38 lbs

For 12" and 14" 2500 lb valves, operating pressures 3500 psi to 4500 psi

IMPACTOGEAR WITH ELECTRIC WRENCH

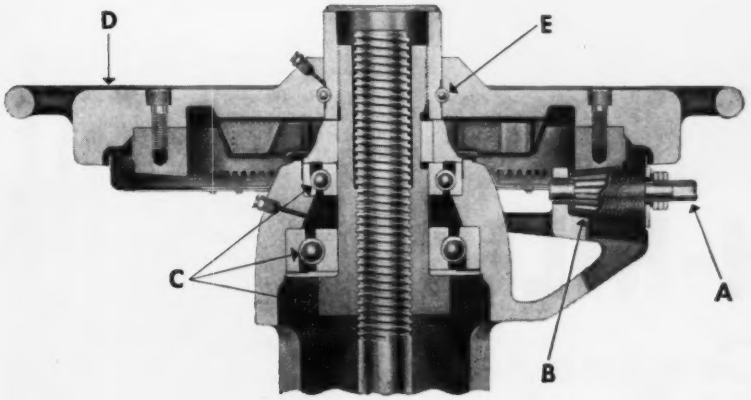
Portable electric wrenches are equally practical. Example below shows a typical electric wrench rating as applied to Impactogear:

Wrench Type No. 1—Stall torque 176 ft-lbs: Free speed 225 rpm; Weight 44 lbs

For 10" 2500 lb valves, all allowable operating pressures

For 10" and 12" 1500 lb valves, all allowable operating pressures

For 12" and 14" 900 lb valves, all allowable operating pressures



Details of new Impactogear and Impactor Handwheel:

A—Hex head of pinion gear shaft. Power wrench is applied here. B—12-to-1 bevel gear ratio is typical for median size handwheel. C—Exclusive EValthrust yoke bushing combines radial and thrust bearings for easy operation and long life. D—New Impactor handwheel concentrates mass near outer circumference for maximum impacting efficiency. E—New extra bearing increases operating efficiency.

SLASH COST OF VALVE OPERATION

Individually installed operating motors are a big investment. They can add as much as 100% to the basic valve cost. *But now you can save that*

LIGHTWEIGHT PORTABLE WRENCH can operate as many Impactogear-equipped valves as desired. Or, each valve can be fitted with its own wrench. Either way, you get lower operating costs. Final closing is effected by handwheel lugs (A) striking hammer blows against cross arm keyed to yoke bushing (B). Half of gear cover was removed for illustration purposes.

money by standardizing on Impactogear —radically simple, thoroughly dependable mechanism utilizing *existing* compressed air or electric facilities. Your Edward Representative will be glad to provide full details and help you determine how Impactogear can work to your best advantage. Contact him —or write *Edward Valves, Inc., 1230 W. 145th Street, East Chicago, Indiana.* (Subsidiary of Rockwell Manufacturing Company). Represented in Canada by Lytle Engineering Specialties, Ltd., 360 Notre Dame St., W., Montreal 1, Quebec.

*T.M. Reg. U.S. Pat. Off.

EDWARD STEEL VALVES
another fine product by
ROCKWELL

Catalog 14 contains full data on the complete Edward line of forged and cast steel valves from ¼" to 18"; in globe and angle stop, gate, non-return, check, blow-off, stop-check, relief, hydraulic, instrument, gage and special designs; for pressures up to 10,000 lbs. with pressure-seal, bolted, union or welded bonnets, with screwed, welding or flanged ends.

For more facts circle 214 on Reader Service card, p 97

Up goes the Mono-Block® Down go the Costs...

as Memphis Insulates NATION'S LARGEST MUNICIPAL STEAM PLANT

A picture can't show you all the advantages of B-H Mono-Block. A flick of the wrist and you've cut just the hole needed for tie wires. A quick slanted slice and you've mitered for a curved surface; reverse the block and the job is done. Then there's inventory! For all jobs up to 1800° F, this one block will serve. Stock the 2″ material; for the upper range you can use two layers. With a "K" of .35 at 200° F, correct operating temperatures are assured with maximum fuel savings.

The bigger the job the more you save in application. If you have a job, large or small, get the efficiency and economy provided by Mono-Block. Request contract application service (available in 48 states) and watch the costs go down.

Insulation Contractor:
M. H. Ellis Company,
Memphis, Tenn.

For more information on B-H Mono-Block and other B-H Insulations, write for catalog or see it in Sweet's Plant Engineering File.

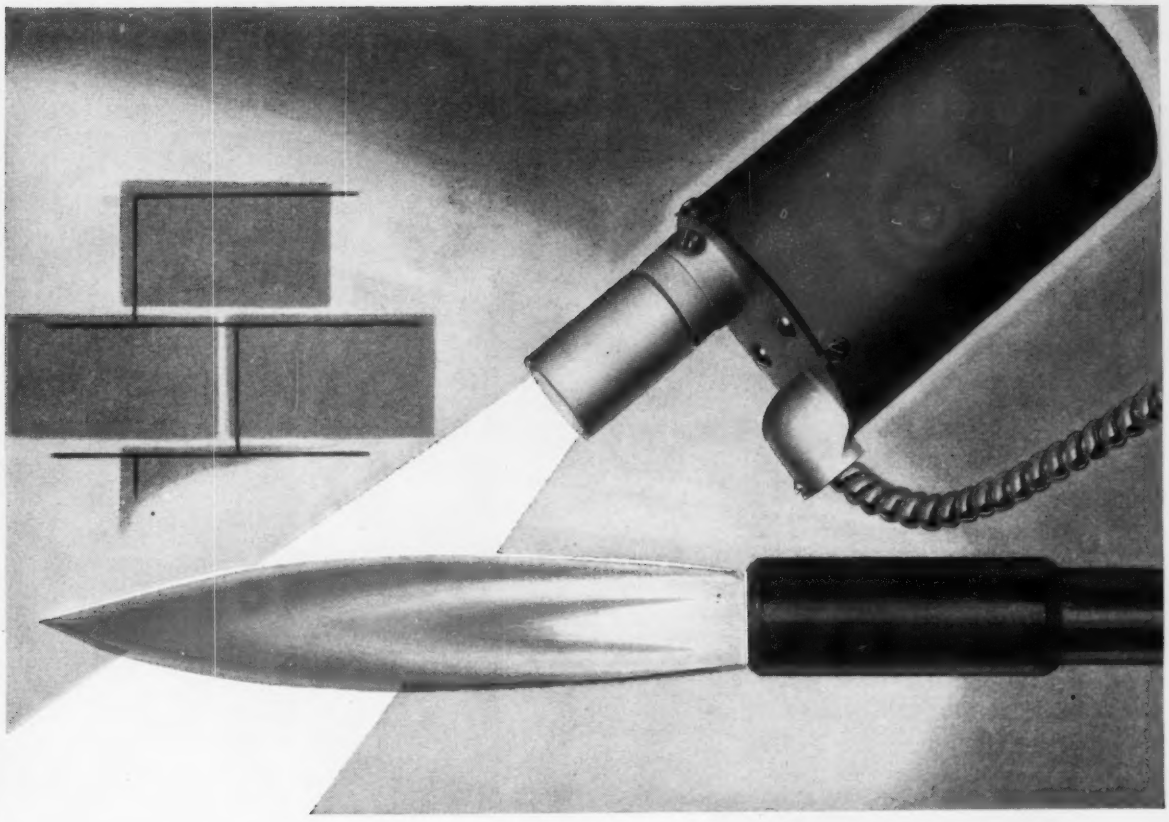
BALDWIN-HILL Company

BALDWIN HILL BH INSULATIONS

CONTRACT APPLICATION SERVICE AVAILABLE

105 Breunig Ave., Trenton 2, N. J.

Kalamazoo, Mich. . . Huntington, Ind. . . Temple, Tex.



New Honeywell Flame Detector

not fooled by hot refractory or glowing carbon...

The ultimate in both safety and convenience, *Ultra-Vision Flame Detector responds *only* to ultraviolet—not to infrared**

Here's the *only* visual flame detector that can tell the difference between real flame and red-hot refractory or glowing carbon. It responds to nothing but the ultraviolet energy given off by flame and sparks, and can't be fooled. It cuts off fuel delivery on flame failure alone, and completely eliminates nuisance shutdowns.

Use the new *Ultra-Vision* Flame Detector to supervise gas-fired, oil-fired or oil-gas burners—it detects a flame from any type of fuel. This one unit keeps an eye on both the pilot and main flame. Use it with any standard rectification-type flame safeguard system, such as the *Protectoglo*. The *Ultra-Vision* sensor is easy to install, because it is insensitive to the refractory, and can be aimed at the flame from any convenient direction.

Now, for the first time, it's possible to have positive flame protection where protection formerly was difficult or impossible—in radiant cup burners and gas generators used to produce atmospheres for heat treating furnaces, for example.

Get complete details from your nearby Honeywell field engineer. Call him today... he's as near as your phone. Or write for Bulletin 95-2776.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

*Trademark

Honeywell

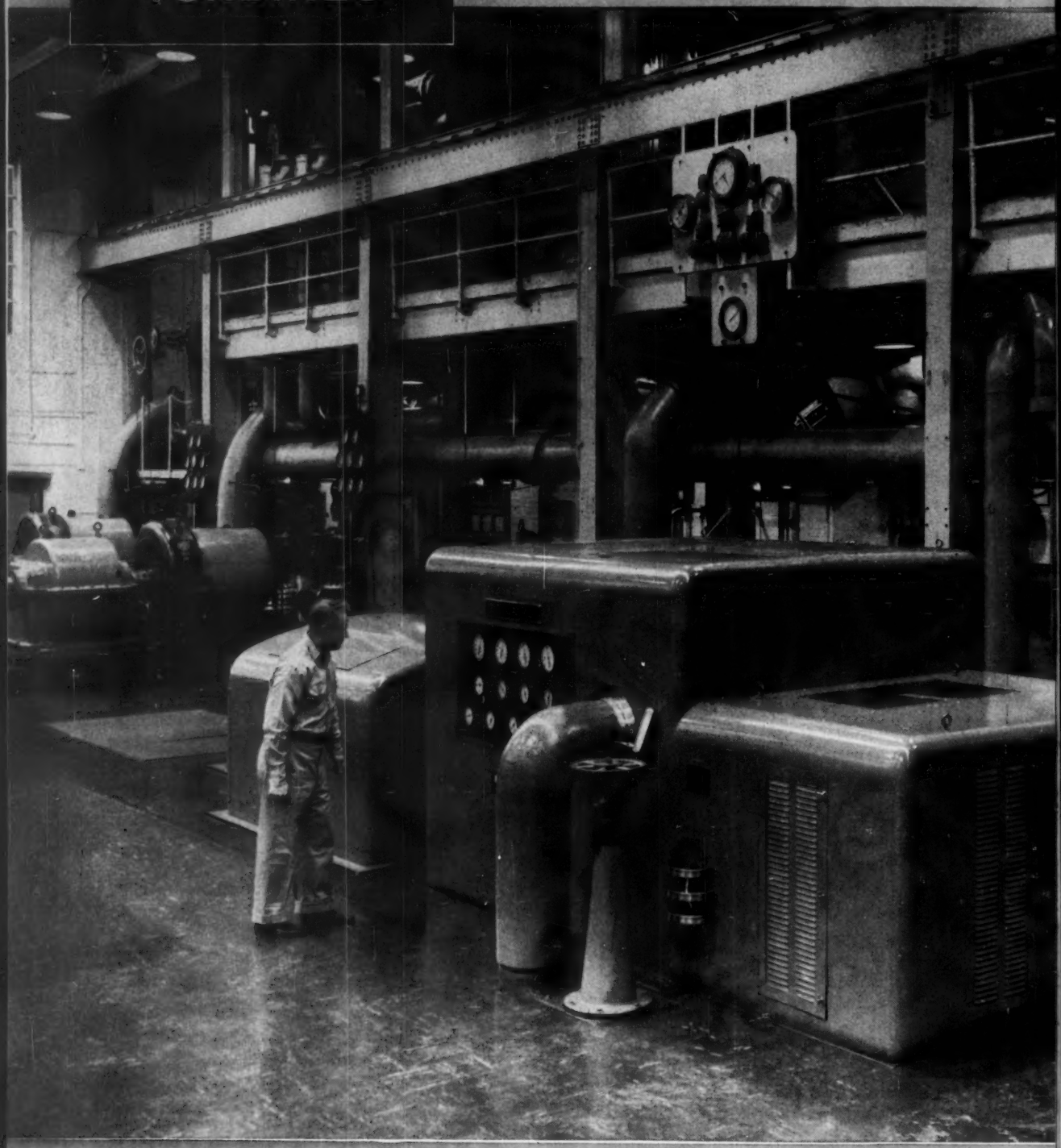
H HONEYWELL

First in Control

For more facts circle 216 on Reader Service card, p 97

DE LAVAL STEAM TURBINES

for process industries



The photograph above shows a De Laval direct-connected turbine generator installation at Parke, Davis & Co., Detroit, Michigan.

This controlled extraction, controlled back-pressure unit supplies 2000 kw using process steam. Extraction is at 130 psig, exhaust is 5 psig. This new machine was added to already existing De Laval units that have been in service for 30 years. In addition, the Parke-Davis Research Laboratories in Ann Arbor, Michigan will soon be using a new 1000 kw unit.

DL-648

Parke, Davis & Co. uses DE LAVAL Steam Turbines for process and power generation

Proved economy, dependable service

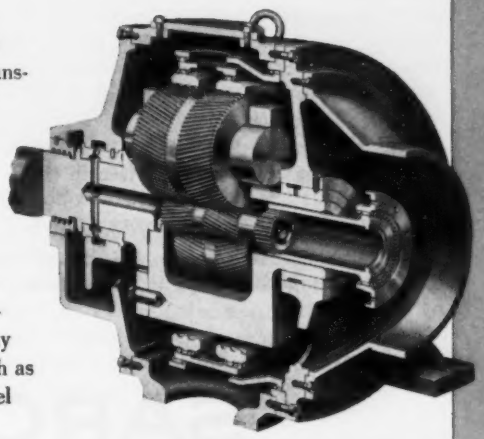
In many process industries, an important by-product is economical electric power. If appreciable quantities of process steam are used, power generation can be achieved at comparatively low cost.

De Laval, pioneer in high speed rotating machinery, has continued to maintain engineering and manufacturing leadership. If you have process application where low-cost power generation can be utilized, call on De Laval.

De Laval-Stoeckicht Planetary Gears

In many applications where high speed and high horsepower are transmitted, the De Laval-Stoeckicht planetary gear can be used to great advantage. It is also used as a speed increaser or decreaser in many industrial installations.

Among its outstanding characteristics are light weight, in-line construction and space saving. It may be used for all kinds of drives such as gas turbines, steam turbines, diesel engines, etc.



Write for Bulletin 2400

DE LAVAL *Steam Turbine Company*

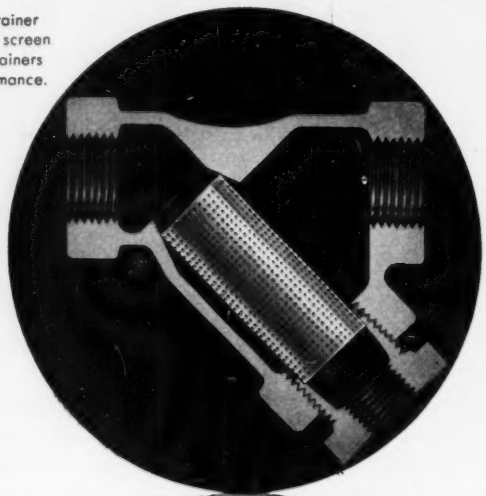
815 NOTTINGHAM WAY, TRENTON 2, N. J.

protect your equipment against scale and dirt

Exterior view of NEW Sarco Type "AT" Pipe Line Strainer. Note 45° blow-down angle to facilitate piping away from strainer.

with this

NEW SARCO TYPE "AT" PIPE LINE STRAINER



Cutaway of NEW Sarco Type "AT" Strainer shows sediment collection chamber below screen. Standard screen used in Sarco "AT" Strainers is key to their uniformly successful performance.

Examine one of the new Sarco Type "AT" Strainers and you'll notice at once that its design is a marked improvement over that of contemporary strainers... in three important ways:

The Sarco screen, key element of the unit, fits tightly into a long, tapered screen seat. This feature absolutely stops the by-passing of particles around the screen. Secondly, the rigid, welded construction of heavy-gauge brass makes sure the fit will remain tight, even when trapped sediment builds up pressure.

Third, you'll see that the new AT is easy to clean. No sharp edges or weave crevices in the screen for particles to cling to. Blow-down cleaning is simplified by the 45° angle construction.

Write for Sarco Bulletin No. 1210B which gives dimensions, capacities, and technical data. 7317-B

NOTE THIS ADDED PROTECTION AND CONVENIENCE

1. Bodies of heavy-duty 250 psi semi-steel. Tensile strength to 30,000 # per square inch minimum.
2. For maximum strength, bodies are reinforced with external rib.
3. Long, tapered screen seat assures correct screen position and tight fit without buckling.
4. Cap design provides a sediment collection chamber below screen.
5. Generous proportion of open screen area in relation to pipe size minimizes pressure drop.

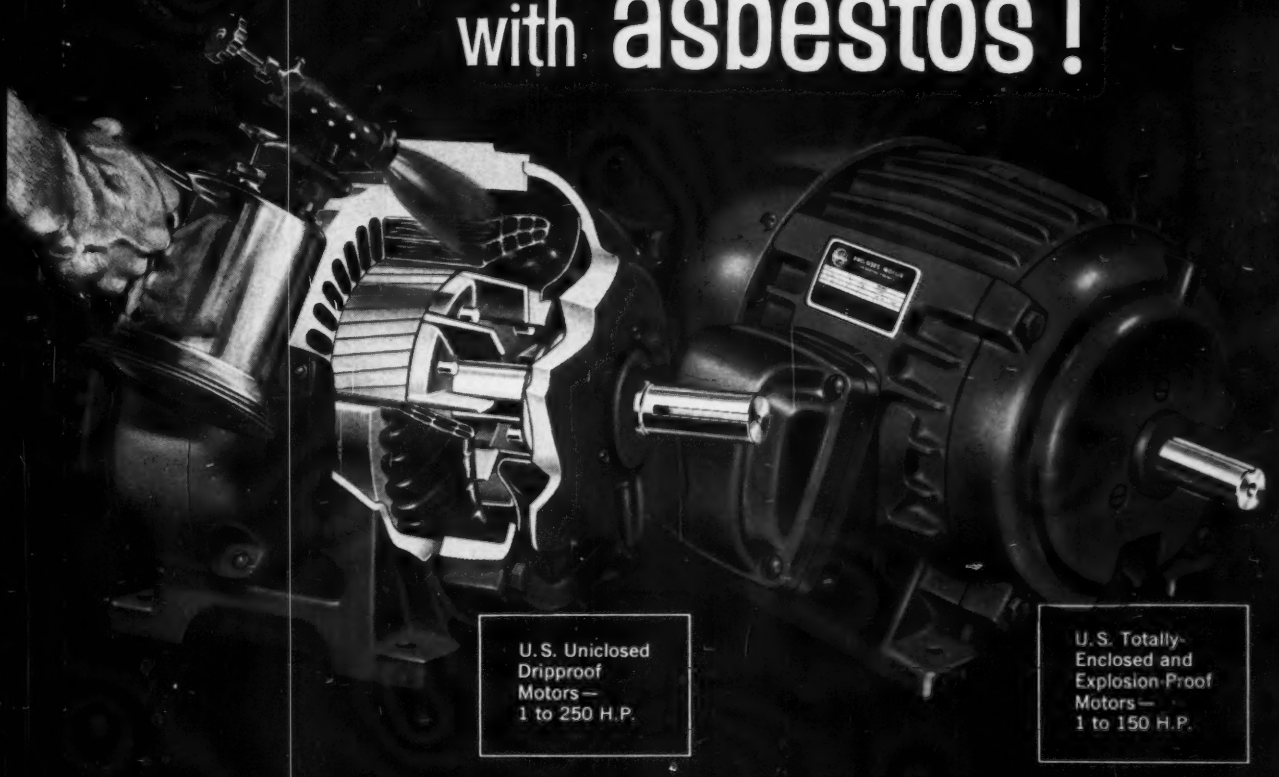
SARCO
COMPANY, INC.
635 Madison Avenue, New York 22, N. Y.

STRAINERS • STEAM TRAPS • TEMPERATURE CONTROLLERS • HEATING SPECIALTIES

For more facts circle 218 on Reader Service card, p 97

only **U. S. MOTORS**

insulates all windings with asbestos!



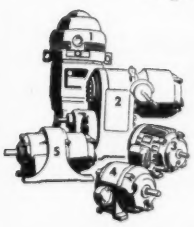
U. S. Uniclosed Dripproof Motors— 1 to 250 H.P.

U. S. Totally-Enclosed and Explosion-Proof Motors— 1 to 150 H.P.

your best protection against motor burn-out and production shut-downs

Only U. S. offers this protection! ALL windings insulated with asbestos—nature's million-year-old insulating material that *cannot carbonize!* Many motor makers use varnished paper, cloth, oiled linen, pressboard, fish-board—even insulating varnish alone. All these will carbonize... not one is fire-proof!

Only the original, patented U. S. ASBESTIC PROCESS—gives you: 1—*heat resistance*... can't carbonize, 2—*heat conductance* better than any cellulose material, 3—*moisture resistance*... due to exceptional impregnation and coating of all motor windings. Protect against costly production stoppages due to motor burn-out! Specify: "U. S. MOTORS"!



U.S. ELECTRICAL MOTORS INC.

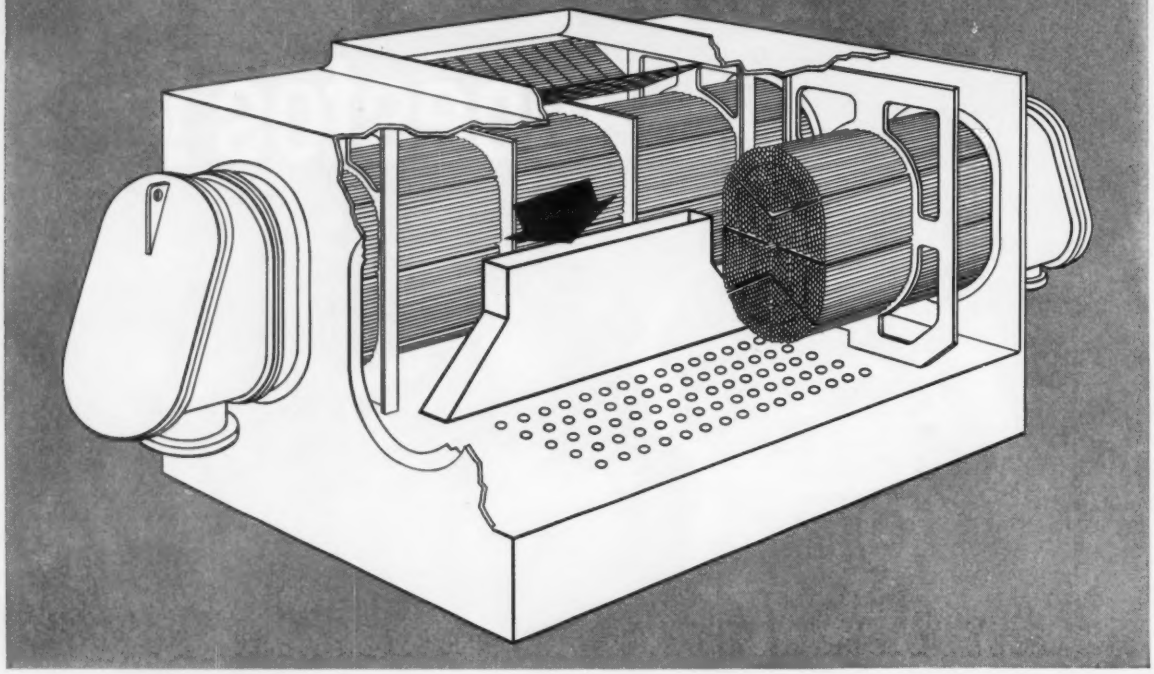
BOX 2058, LOS ANGELES 54, CALIFORNIA
OR MILFORD, CONNECTICUT

U.S. MAJOR MOTOR LINES INCLUDE:
1. Vertical Solid & Hollowshaft, 2. Varidrive, 3. Totally-Enclosed, 4. Uniclosed, 5. Syncrogear. Also, many other special motors.

FREE COLOR-ILLUSTRATED BROCHURES...
For specific data on asbestos protection, write for General and Type H Uniclosed Bulletins.

For more facts circle 219 on Reader Service card, p 97

pressurizing steam scoop...
the key to fully effective 2nd stage deaeration



One of many features singling out

ROSS SURFACE CONDENSERS

It's a fact: The Ross Surface Condenser design provides the most effective means of condensate deaeration... due in a large measure to a unique pressurizing steam scoop.

Following its initial deaeration in the main tube banks and shell, the condensate is further deaerated in the hotwell. It is in this second stage that the scoop performs its important role.

As high velocity steam rushes downward through the condenser shell, it is trapped in the steam scoop. Here its velocity energy produces additional pressure and higher temperatures for the hotwell. Live pressurized steam from the scoop flows through the condensate which is cascading over the deaerating trays within the hotwell . . . further deaerating the condensate and sweeping the released non-condensibles towards the air removal system. Maximum oxygen removal is thus accomplished.

A multitude of benefits await your appraisal in the modern Ross Surface Condenser. Discussing them with a representative will be well worth your while. Make a date at your convenience, and in the meanwhile request Bulletin 8.2K1.

American-Standard* Industrial Division, Detroit 32, Michigan. In Canada: American-Standard Products (Canada) Limited, Toronto 4, Ont.

*American-Standard and Standard ® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
INDUSTRIAL DIVISION

AMERICAN BLOWER PRODUCTS • KEWANEE PRODUCTS • ROSS PRODUCTS

For more facts circle 220 on Reader Service card, p 97

Hall Industrial Water Report

VOLUME 7 MAY 1959 NUMBER 3

Take the Simpler Things in Life

What could be simpler than water, air, salt? Or more essential to life? Yet they can destroy steel, copper and other common metals and alloys used extensively in industry.

The Hall engineer is trained to recognize corrosion problems in the making and how to combat them. He can help you locate trouble spots and recommend corrective measures before serious damage has been done. That is one of the reasons why the services of Hall engineers are in demand wherever water is used for boilers, cooling, process or general service.

Corrosion Slows Production

When Hall engineer W. E. Pfeiffer visited a new client he was immediately handed a costly problem. When the weather became extremely cold the part of the plant farthest from the boiler house could not be kept comfortably warm, so that the assembly line had to be slowed.

Although repairs to the condensate return system had been minor, Pfeiffer suspected that corrosion products were interfering with heat transfer and proper circulation in the heating system. His suspicion was confirmed when it was shown that condensate was dissolving iron from the piping.

To control further corrosion and to disperse existing corrosion products, Pfeiffer recommended addition of filming amine (Hagafilm®) to the boiler feed water. As the amine distilled out of the boiler with the steam, it loosened corrosion products and laid down a protective film on the metal surfaces wherever steam condensed. With the initial cleanup period over, heating the whole plant is no longer a problem.

Seeing Spots

A Washington hospital reported to Hall engineer W. R. Greenaway that contamination of steam used in autoclaves was spotting stainless steel surgical instruments plated with chromium and nickel. By examining the instruments with a microscope, Greenaway found the problem was indeed serious. The spots were not just stains, they consisted of clusters of tiny pits.

Corrosion of stainless steel pointed to chloride. None was found in condensed steam samples. Only negligible amounts were present in the water and detergent used for washing. As a last resort Greenaway rinsed with distilled water the cloth used to wrap the instruments. A check on the washings proved the cloth to be the source. Condensing steam in the autoclaves extracted enough chloride from the cloth to cause the difficulty.

The job wasn't quite complete. A trip to the laundry was necessary. There it was found that a compound used in the last rinse was high in chloride. Since this has been omitted there has been no further trouble.

Red Carpet Treatment

Stains and poor dyeing caused by iron oxide plagued a Southern carpet factory. Thousands of yards of woolen yarn had to be reworked and sold at substandard prices.

The call went out for a Hall engineer. H. V. Gedney's quick check of the wash water from the scouring lines showed it to be deep red in color. He then surveyed the plant water system from the intake to the trouble points. After clarification the water was satisfactory. But corrosion increased iron content gradually from the filters through the water heater, storage tank and service lines.

With the problem in focus, Gedney had the plant start threshold treatment for corrosion control with Calgon® Composition TG. The red water problem was stopped almost immediately.

Serious water problems can't always be solved in one day. However, the Hall engineer's training and experience enable him to get at the cause of most troubles quickly.

Water is your industry's most important raw material. Use it wisely.

Protective Coatings

Successful application of most coatings to water storage tanks is limited by several factors: water temperature, coating porosity, abrasion and water contamination. But maintaining the continuity of a coating on submerged portions of tanks is extremely important. The tanks are subjected to an oxygen concentration cell type of attack which tends to center corrosion at breaks in the coating. This can cause rapid perforation instead of slow, even corrosion of the total surface.

The organic barriers can be grouped into three large categories: Elastomers include the natural rubber and synthetic products like neoprene. Thermosetting resins cover the alkyd, phenolic and epoxy groupings plus the newer silicones. Thermoplastic materials embrace the vinyl and vinylidene chlorides and polyethylene plus the various coal tar and asphalt base bitumens. Combinations of various resins, resins and metallics, and resins and bitumens are being used extensively.

In many cases, a coating gives unsatisfactory service because it is not applied properly. All corrosion products and other foreign matter must be removed from the surface to be coated. Sandblasting and wire brush cleaning generally work out better than chemical cleaning unless after-rusting can be prevented.

To summarize, protective coatings can frequently be used to protect water tanks if the proper material is used and adequate care is taken in cleaning the metal surfaces and in applying the material.

Industrial Water Problems Require Special Handling

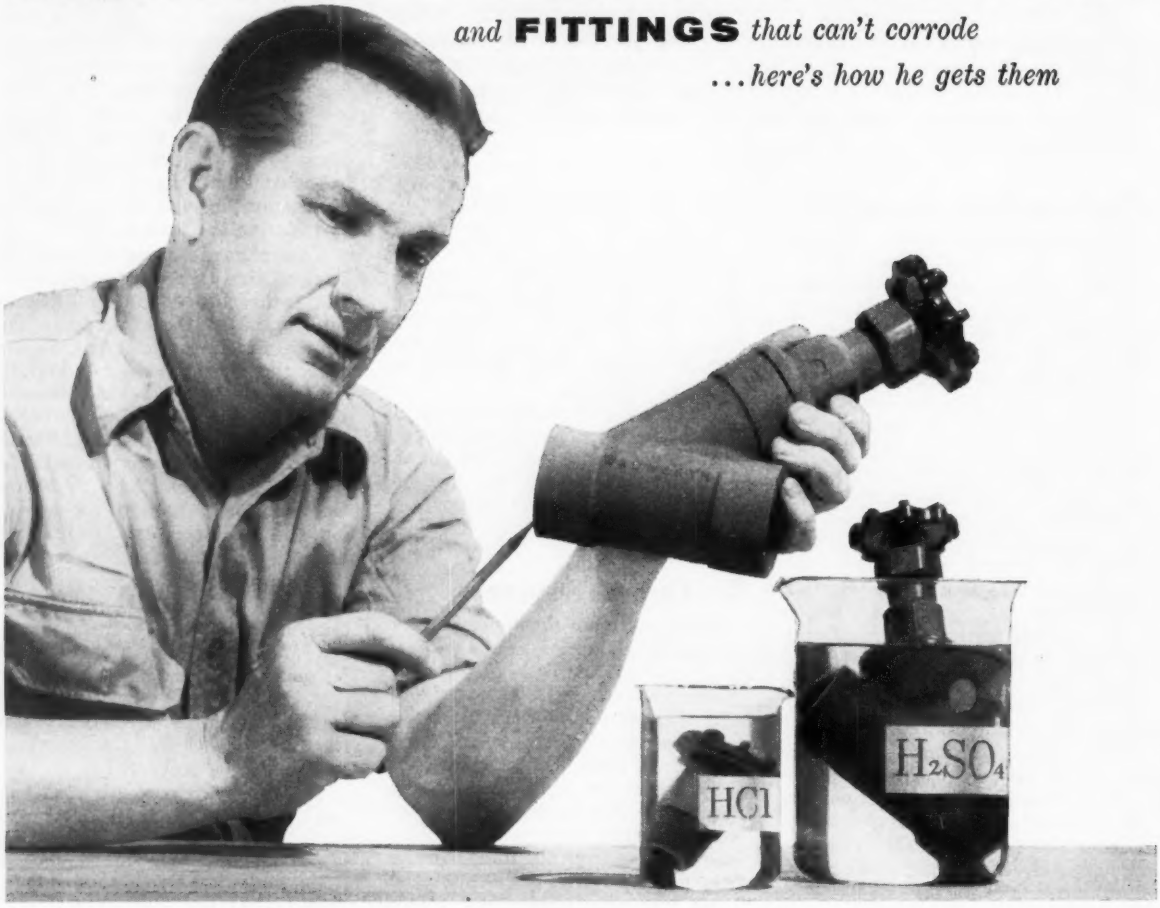
There are no "stock answers" to industrial water problems. For information on how the Hall System can help you solve your particular water problems, write, wire or call address below.

HALL LABORATORIES
DIVISION OF HAGAN CHEMICALS & CONTROLS, INC.
HAGAN BUILDING, PITTSBURGH 30, PA.
In Canada: Hagan Corporation (Canada) Limited, Toronto

Hall Laboratories—Consultants on Procurement, Treatment, Use and Disposal of Industrial Water

For more facts circle 221 on Reader Service card, p 97

the **WALWORTH CUSTOMER** *wants* **PLASTIC VALVES** *and* **FITTINGS** *that can't corrode ...here's how he gets them*



When the Walworth Customer is faced with the control of corrosive fluids, he looks at dozens of plastic valves and checks them for himself. He demands answers to questions like these: Can this valve corrode? Is it toxic? Is it non-aging? In Walworth PVC Valves and Fittings, the Walworth Customer finds his answers. Not only is PVC nontoxic and non-aging, – it *can't* corrode. *All* parts are made of plastic. Valves and fittings have high burst strength. Given those facts the Walworth Customer buys.

That may be the way you like to buy valves, too. If you insist on knowing about materials, workmanship and high quality, we'd like you for a Walworth Customer, too. For the newest literature on the complete line of PVC Valves and Fittings, get in touch with your Walworth Distributor.

Or write **WALWORTH** *750 Third Avenue, New York 17, N. Y.*

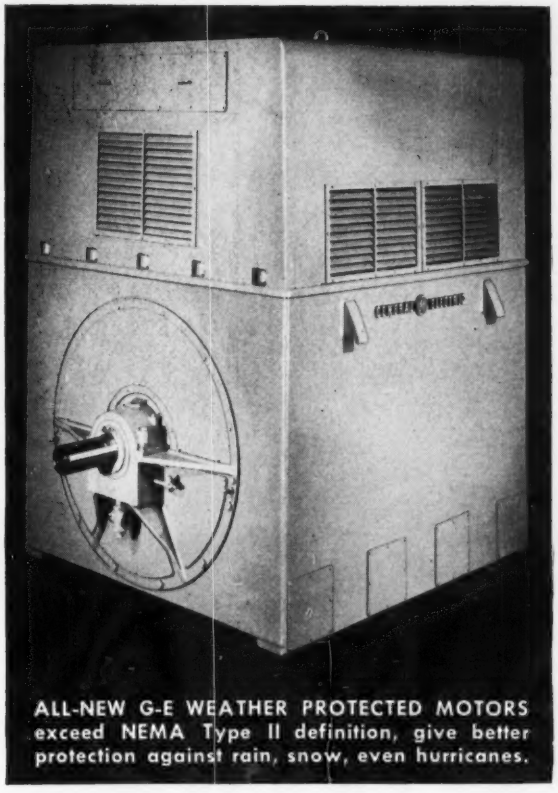
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

WALWORTH SUBSIDIARIES: ALLOY STEEL PRODUCTS CO. • CONOFLOW CORPORATION • GROVE VALVE AND REGULATOR CO. M&H VALVE & FITTINGS CO. • SOUTHWEST FABRICATING & WELDING CO., INC. • WALWORTH COMPANY OF CANADA, LTD.

For more facts circle 222 on Reader Service card, p 97

FROM GENERAL ELECTRIC . . .

New Custom-designed Power Station Motors Provide Better Protection, Easy Maintenance



ALL-NEW G-E WEATHER PROTECTED MOTORS exceed NEMA Type II definition, give better protection against rain, snow, even hurricanes.

Now, you can get a new General Electric motor custom-designed for your specific power station requirements. Nine custom-designed enclosures—eight custom-designed insulation systems—seven custom-designed bearing and end shield constructions—more than 15 custom-designed accessories—and a countless number of electrical designs: these give our engineers freedom to create a power station motor that can meet your exact needs. General Electric's all-new weather protected motor, shown at left, is one example of how a motor can be custom-designed for its particular application.

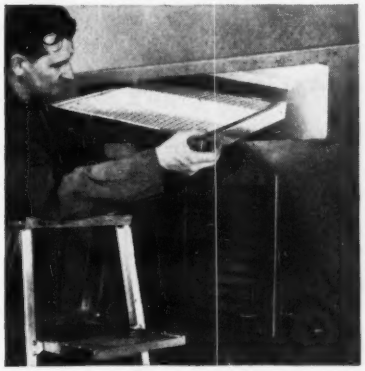
CUSTOM-DESIGNED FOR BETTER PROTECTION—Unique labyrinth baffling system of new weather-protected motor forces incoming air to make a series of right-angle turns and reductions in velocity before entering motor. And, special "blow-through" passages give extra protection against high-velocity winds.

CUSTOM-DESIGNED FOR EASY MAINTENANCE—New end shield is lightweight, easy to remove and disassemble, eliminating need for crane or lifting rig. Vistamatic sight gages are located on top and both sides allowing oil ring observation and easy reading of oil level.

CUSTOM-DESIGNED FOR GREATER ACCESSIBILITY—Removable top section provides access to all air passages and baffles for easy inspection, maintenance. Motor windings and bearings are easy to reach because of new end shield which is lightweight and easily removed.

FOR MORE INFORMATION on General Electric custom-designed power station motors, contact your nearby G-E Apparatus Sales Office or write to Section 884-1, General Electric Co., Schenectady, N.Y.

GENERAL ELECTRIC

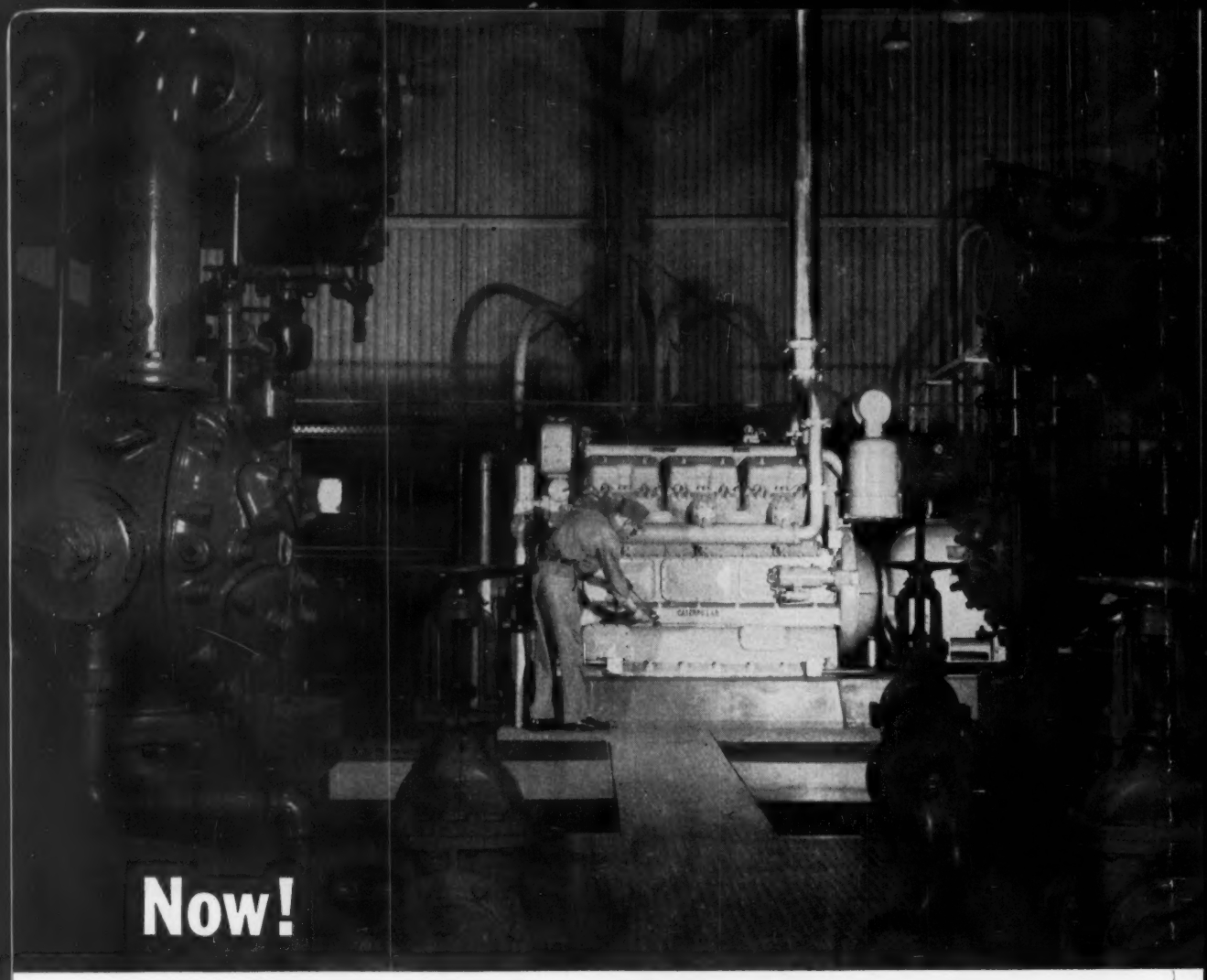


TOP ACCESSIBILITY—Air passages in top section are completely accessible through nine openings. Filter installation or inspection is fast and easy.

BETTER PROTECTED AIR OPENINGS—"High up" air intake passages of new G-E motor prevent snow, trash, dust or dirt from being drawn into the motor.

SIMPLIFIED MAINTENANCE—Removable, lightweight end shield permits complete accessibility to motor interior, bearings without disturbing alignment.

For more facts circle 223 on Reader Service card, p 97



Effective auxiliary equipment maintenance requires no more than 4 lubricants

Get important reductions in inventory and maintenance costs with Texaco Organized Lubrication

A small group of multi-purpose lubricants, organized by Texaco into a simplified plan, is rapidly replacing numerous specialty products in auxiliary power equipment applications.

As a result of this plan, inventory is cut sharply; storage space is saved. Misapplication dangers are substantially reduced. Lubrication rounds take less time—labor costs go down.

A Texaco Lubrication Engineer will be glad to tell you how the Organized Lubrication Plan can help you cut maintenance costs in your plant. Just call the nearest of the more than 2,000 Texaco Distributing Plants, or write:

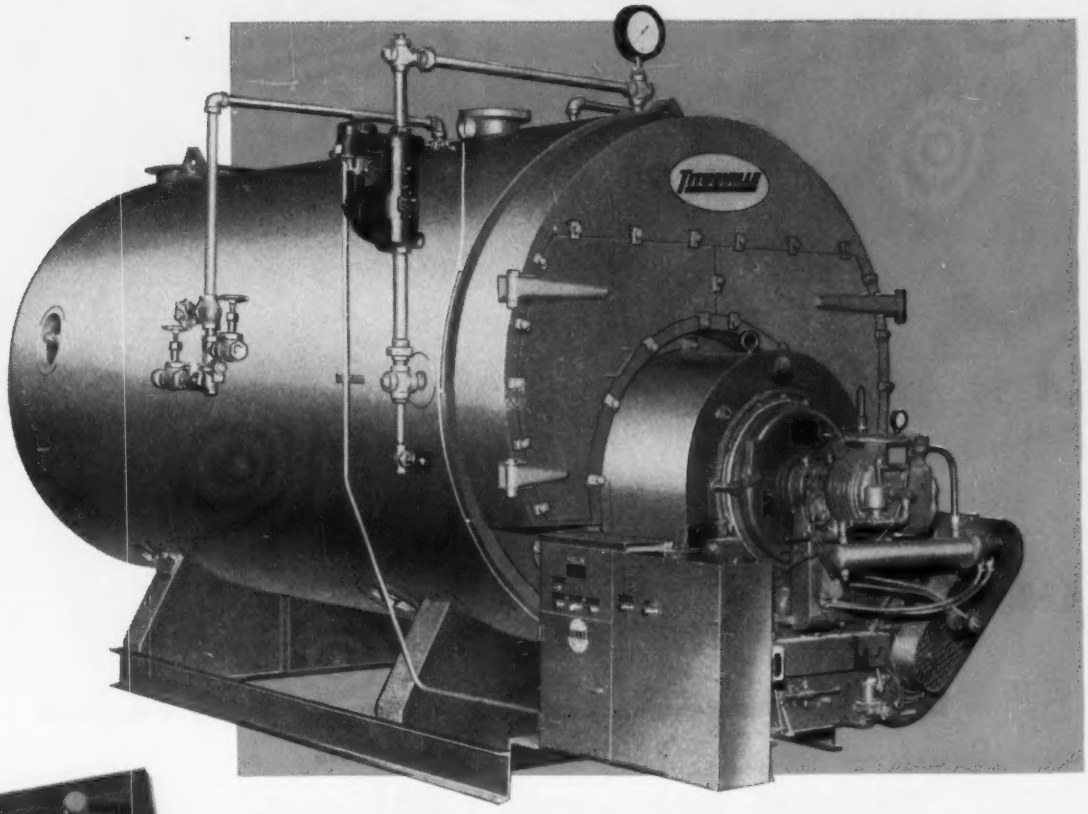
The Texas Company, 135 East 42nd Street, New York 17, N. Y.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

For more facts circle 224 on Reader Service card, p 97

Now... meet the Titusville TITAN



Send today for your free copy of the new TITAN Bulletin B-3240 . . . contains full data on the TITAN Unit line.

3-PASS UNIT

with complete wet back

The TITAN 3-Pass Unit brings you today's highest development in mechanical and thermal efficiency for exacting power and heating applications. Compact design in every size joins with TITAN's all-wet-back construction, water-cooled rear combustion chamber and modern 3-pass heat transfer to make this unit *your first consideration* when boilers are up for discussion. Let us consult with you, now!

A Division of

Struthers Wells

THE TITUSVILLE IRON WORKS CO.

BOILER DIVISION: BOILERS for Power and Heat . . . High and Low Pressure . . . Water Tube . . . Fire Tube . . . Package Units. **PROCESSING EQUIPMENT DIVISION:** Crystallizers . . . Direct Fired Heaters . . . Evaporators . . . Heat Exchangers . . . Mixing and Blending Units . . . Quick Opening Doors . . . Special Carbon and Alloy Processing Vessels . . . Synthesis Converters. **FORGE DIVISION:** Crankshafts . . . Pressure Vessels . . . Hydraulic Cylinders . . . Shafting . . . Straightening and Back-up Rolls

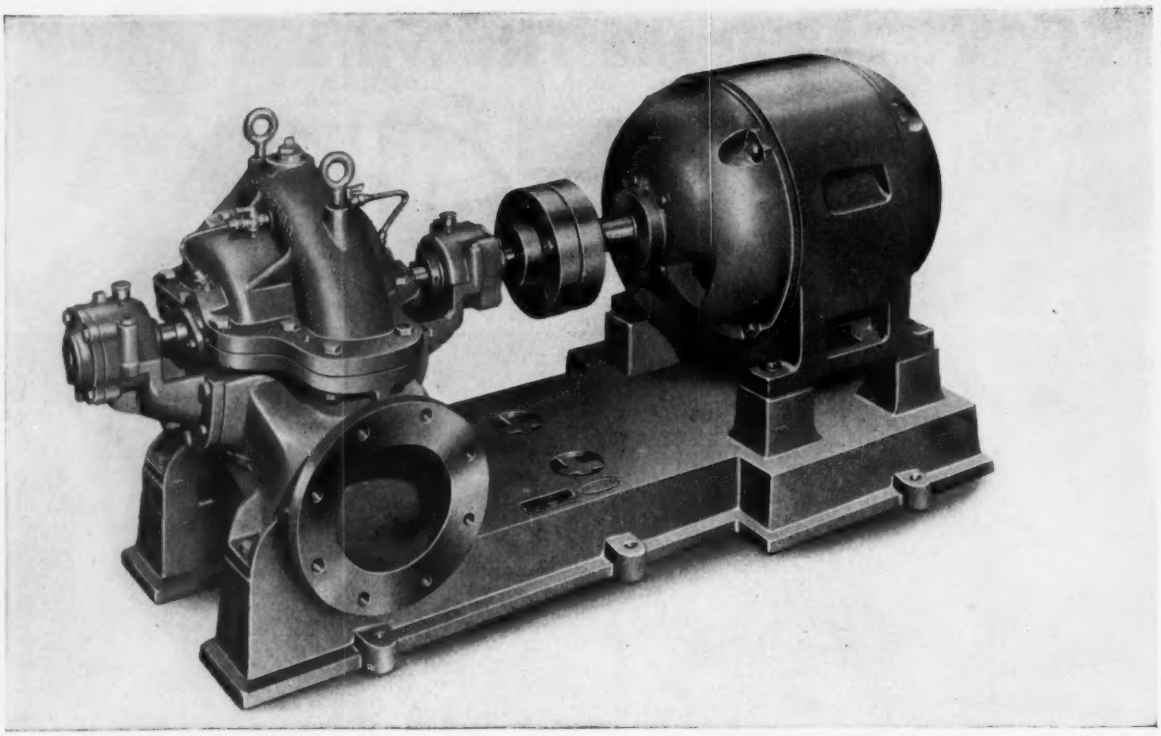
TITUSVILLE, PENNSYLVANIA

Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement

Plants at Titusville, Pa. and Warren, Pa.

Offices in Principal Cities

For more facts circle 225 on Reader Service card, p 97



"Buffalo" Double Suction Pump for Clear Water Service

3-WAY ECONOMY
WITH THESE "BUFFALO" PUMPS

1. Minimum Maintenance Cost 2. Minimum of Costly Time-Outs
3. Minimum Service Costs

"Buffalo" Double Suction Pumps bring you these and many more economies because they combine superior hydraulic design with the finest quality workmanship and materials.

Lower maintenance cost and fewer expensive time-outs are the result of these "Buffalo" construction features: sturdy, machined casing with ample, simply-formed water passages — hydraulically balanced impellers assuring peak efficiency — renewable bronze wearing rings — heavy-duty ball bearings and shaft is high grade steel, machined all over, bronze covered, or solid monel metal or other alloy.

Lowest possible service costs are assured by the extra accessibility designed into these pumps. Horizontally-divided casing permits quick removal of the upper half. Thus interior parts can easily be inspected or removed without disturbing pipe connections.

Add to these economies peak efficiency and dependability and you have a pump that is unsurpassed for the most severe industrial clear water service.

For full information on the "Buffalo" Double Suction Pump, contact your nearby "Buffalo" engineering representative. Or write for Bulletin 955-S.

"Buffalo" PUMPS

BUFFALO PUMPS
Division of Buffalo Forge Co.
488 BROADWAY • BUFFALO, N. Y.

Canada Pumps, Ltd., Kitchener, Ont. • Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

For more facts circle 226 on Reader Service card, p 97

For more facts circle 227 on Reader Service card, p 97 ➤

IT'S NEW!

IT'S TOUGH!

It's Anchor Style 449 Compressed Asbestos Sheet

The Anchor Packing Company proudly presents this additional packing material—a tough, high quality homogeneous sheet with *superior resistance* to all oils, fuels and refrigerants!

Ankorite #449 is a compressed, Neoprene bonded asbestos. It performs perfectly at pressures up to 400 pounds and at temperatures up to 650°F. Meets Navy Specification MIL-A-7021, Class 1. Will not soften in service. Has long shelf life.

See your Anchor Representative today for further information about Ankorite #449. Or, contact the Anchor General Office in Philadelphia. Ask, too, for your copy of the Anchor catalog.

DISTRICT OFFICES

BALTIMORE, MD.	MINNEAPOLIS, MINN.
BOSTON, MASS.	MONTREAL, CANADA
BUFFALO, N.Y.	NEW ORLEANS, LA.
CHICAGO, ILL.	NEW YORK, N.Y.
CINCINNATI, OHIO	PHILADELPHIA, PA.
CLEVELAND, OHIO	PITTSBURGH, PA.
DAYTON, OHIO	SAN FRANCISCO, CAL.
DETROIT, MICH.	SEATTLE, WASH.
HOUSTON, TEX.	SPOKANE, WASH.
INDIANAPOLIS, IND.	ST. LOUIS, MO.
LOS ANGELES, CAL.	TOLEDO, OHIO
MILWAUKEE, WIS.	WILMINGTON, CAL.

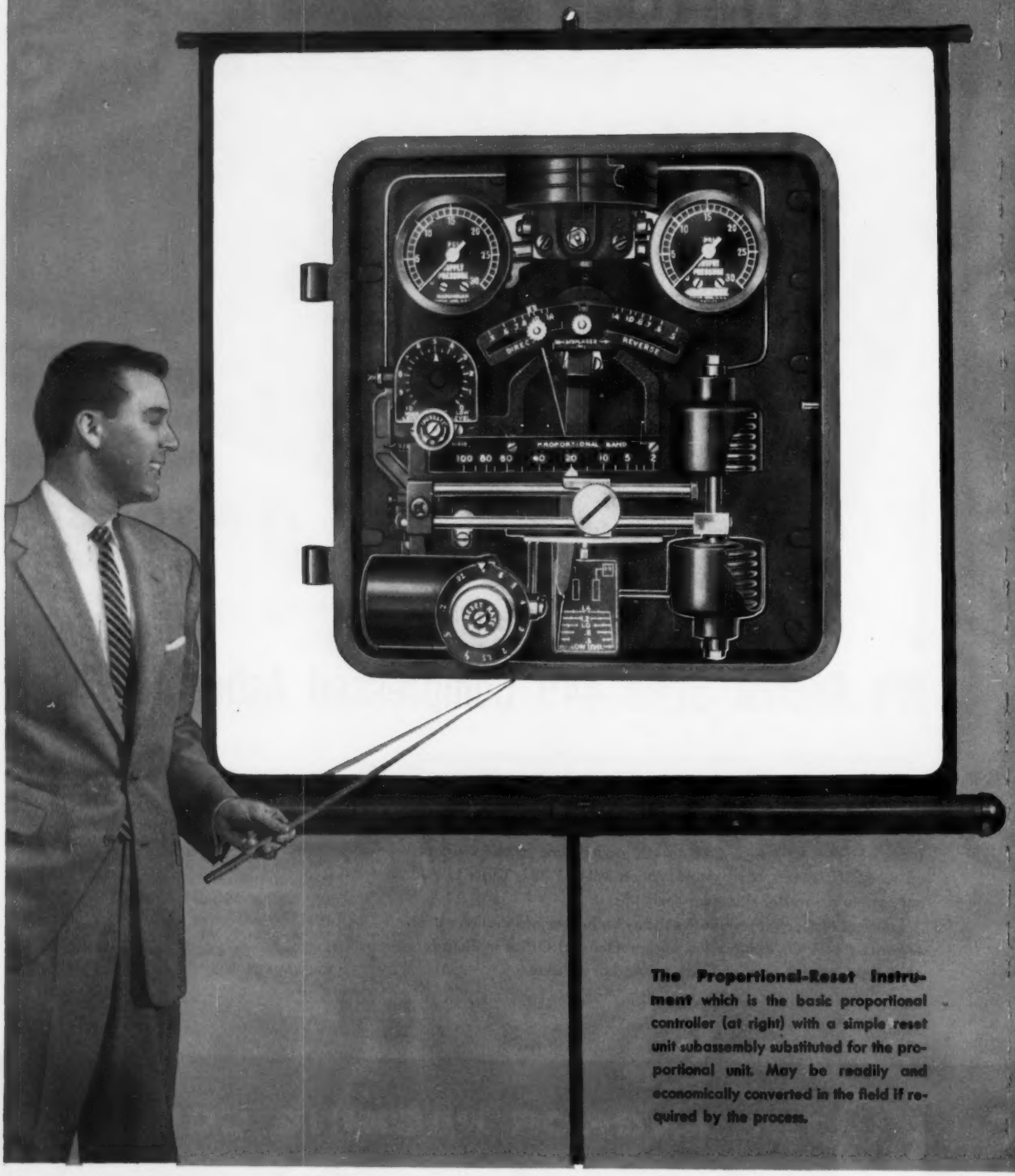
Find it Fast in The 'Yellow Pages'

THE ANCHOR PACKING COMPANY

GENERAL OFFICES . . . PHILADELPHIA, PENNSYLVANIA
FACTORIES . . . MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

● *FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE*

MASONEILAN LEVEL CONTROLLERS



The Proportional-Reset instrument which is the basic proportional controller (at right) with a simple reset unit subassembly substituted for the proportional unit. May be readily and economically converted in the field if required by the process.

DESIGNED FOR SPECIAL APPLICATIONS, TOO!

Versatile 12000 Series Provides Proportional-Reset Action in a Single Case

In addition to meeting all usual liquid level control requirements, the Mason-Neilan design provides for those few special applications where proportional reset action is advantageous, such as . . .

Precise Control — in, for example, short zone, subcooling type feedwater heaters

Wide Proportional Band — without change of control mechanism

Maintaining Accurate Mean Level — for maximum surge capacity

Moreover this reset action is available with the standard instrument — either the single unit or in the duplex type, which may include a transmitter or other controller.

The advantages of such a one-case controller include:

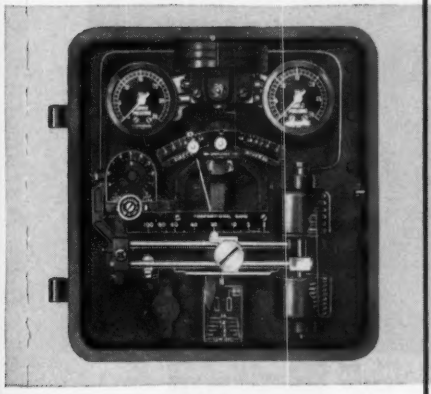
- *Lower Original Cost*
- *A Single, Simple Pneumatic System*
- *Compactness*
- *Easier Start-up and Adjustment*
- *Simpler Installation and Servicing*

Only Masoneilan 12000 Series offers these advantages. It will pay you to get the whole story. Complete, detailed catalog will be sent on request. Ask your nearest representative or write

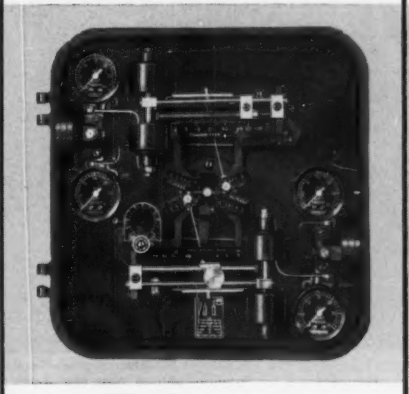
MASON-NEILAN
Division of Worthington Corporation
33 NAHATAN STREET, NORWOOD, MASSACHUSETTS

District Offices or Distributors in Principal U. S. Cities

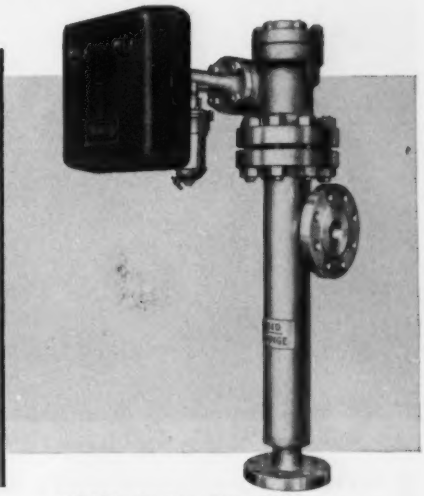
In Canada — Mason-Neilan Regulator Co., Ltd. — Brantford, Montreal, Toronto
European Manufacturing Associates
Crosby Valve & Engineering Co., Ltd., Wembley, Middlesex, England
Worthington, Paris, France
Worthington Gesellschaft M.B.H., Hamburg, Germany
Worthington SIPEC, Milan, Italy
Distributors in many other overseas countries



The Basic Proportional Controller satisfies the vast majority of level control applications. Available also with Pneumatic Set and for Differential Gap control.



The Duplex Controller combines a controller and transmitter (or two controllers) — actuated by a single displacer and torque tube. It is contained in a single larger case.



12000 Series Controllers are available in a wide variety of mountings and connections; level ranges; pressure and temperature ratings — types for all applications.

For more facts circle 228 on Reader Service card, p 97

OVER 50 LimiTorque VALVE OPERATORS ARE USED

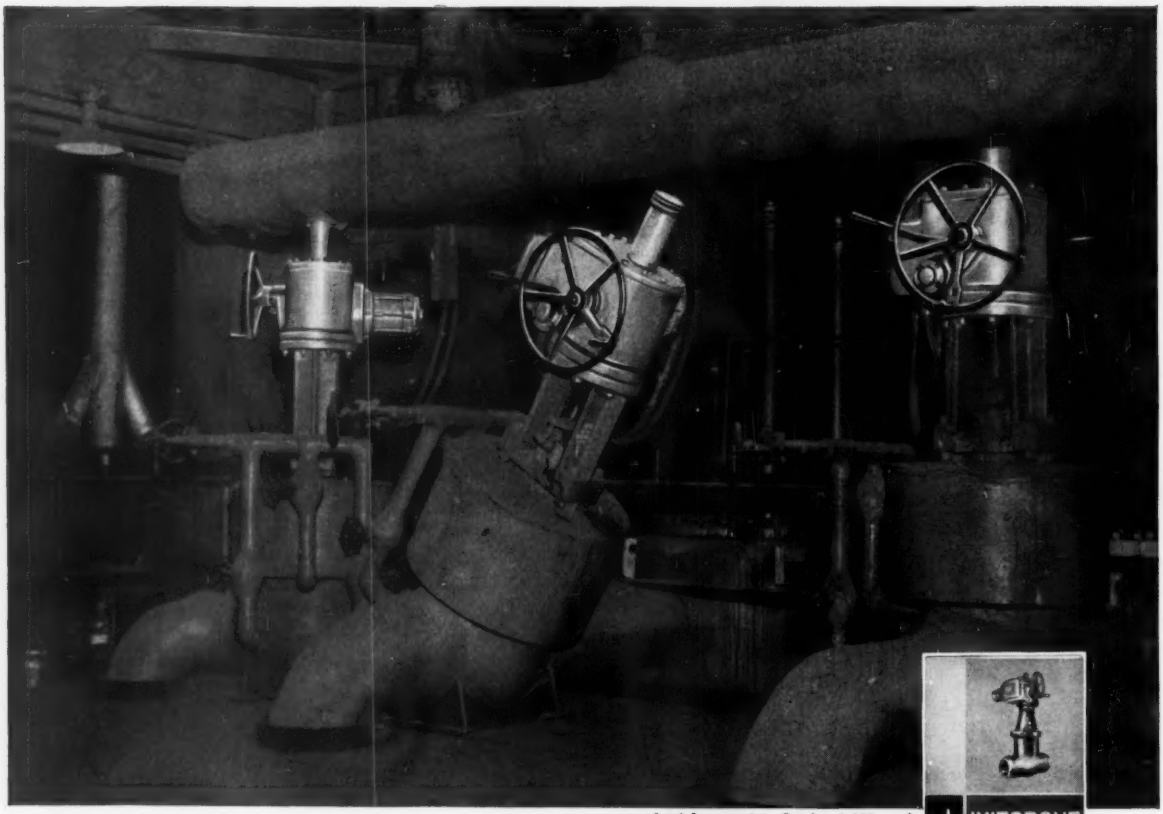
. . . in the East River Generating Station of Consolidated Edison Co.

The illustration below shows three LimiTorque Motorized Valve Operators used on 12" water inlet valves to high pressure feed water heaters . . . there are nearly fifty other LimiTorque Operators used throughout this modern station for various high pressure purposes, on valves ranging up to 20" diameter. We are proud that this modern generating station, like numerous others throughout the world, has chosen LimiTorque Motorized Operators to control their important valves—speedily, safely, surely and economically.

LimiTorque Valve Controls can be mounted on any size valve in nearly any position or location, and they can be readily adapted to existing equipment with electricity, hydraulic pressure, air or high pressure natural gas used as power sources.

LimiTorque provides constant seating thrust . . . assuring an absolutely tight valve on each closure while at the same time, protecting all valve operating parts from overload. Adjustment of the torque limit switch enables operating personnel to compensate for valve wear throughout the life of the valve.

Contact your valve manufacturer, or nearest LimiTorque sales-engineering office.



Send for complete Catalog L-550, and please use your Business Letterhead when requesting a copy.

THERE IS NO SUBSTITUTE FOR —

LimiTorque®

PHILADELPHIA GEAR CORPORATION

ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.

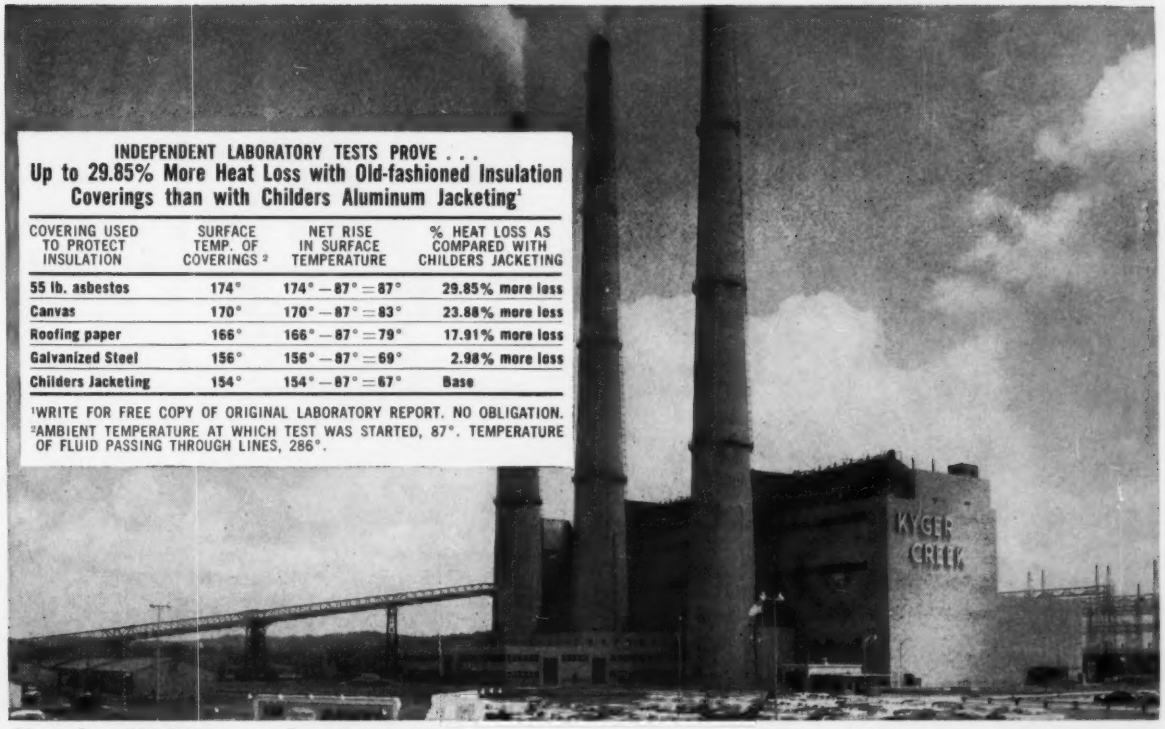
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID AGITATORS • FLEXIBLE COUPLINGS

Limitorque Corporation • Philadelphia

For more facts circle 229 on Reader Service card, p 97

(Advertisement)



INDEPENDENT LABORATORY TESTS PROVE . . .
Up to 29.85% More Heat Loss with Old-fashioned Insulation Coverings than with Childers Aluminum Jacketing[1]

COVERING USED TO PROTECT INSULATION	SURFACE TEMP. OF COVERINGS [2]	NET RISE IN SURFACE TEMPERATURE	% HEAT LOSS AS COMPARED WITH CHILDERS JACKETING
55 lb. asbestos	174°	174° — 87° = 87°	29.85% more loss
Canvas	170°	170° — 87° = 83°	23.88% more loss
Roofing paper	166°	166° — 87° = 79°	17.91% more loss
Galvanized Steel	156°	156° — 87° = 69°	2.98% more loss
Childers Jacketing	154°	154° — 87° = 67°	Base

[1]WRITE FOR FREE COPY OF ORIGINAL LABORATORY REPORT. NO OBLIGATION.
[2]AMBIENT TEMPERATURE AT WHICH TEST WAS STARTED, 87°. TEMPERATURE OF FLUID PASSING THROUGH LINES, 286°.

More than 500,000 square feet of maintenance-free Childers Aluminum Jacketing protect the insulated lines in this modern Kyger Creek Plant of the Ohio Valley Electric Corporation which was rated first in overall thermal efficiency in recent annual ratings of major power plants by the Federal Power Commission.

Power Plants Run 15° to 20° Cooler With Childers Aluminum Jacketing Installed

- **Reduces heat loss by radiation**
- **Lose fewer BTU's per KWH**

. . . yet cost is less than canvas-and-paint

Certified test results prove Childers Jacketing saves money for power plants by increasing the efficiency of any insulation. Its low factor of emissivity keeps heat inside . . . fewer BTU's are lost per KWH.

First cost is less for maintenance-free Childer's Jacketing—*actually less than canvas-and-paint.* You protect your insulation investment at lower cost and get the bonus of a better looking plant and easier housekeeping.

Compare . . . Figure YOUR Savings:

Material & Labor Cost per Sq. Ft.	
Canvas-and-Paint	
8 oz. canvas covering	$ .167
One coat of paint	.044
TOTAL	$ .211
CHILDERS .006" Aluminum Jacketing	.184
Your SAVING per sq. ft.	$ .027

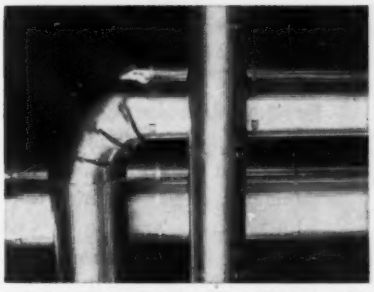
Power engineers at America's leading power plants prefer Childers Jacketing. Exclusive features make installation easy, performance superior —yet, first cost is less than canvas-and-paint.

Engineering Representatives in 27 cities provide technical information and assistance on protection of insulated lines, elbows, towers, vessels, tanks. Only Childers has this nationwide service organization.

For a free copy of the original independent laboratory heat loss report and sample of Childers Jacketing, write to:

Childers Manufacturing Co.
P. O. Box 7467
Dept. P-17
Houston 8, Texas

In Canada, write direct to Peerless Mfg. Co., Sub-Post Office 28, Calgary, Alberta.



CHILDERS FEATURES CUT COSTS:

1. NEW CHILDERS ALUMINUM ELL-JACS solve costly problem of protecting insulated elbows. Give you permanent protection. Precision-formed for both 90° and 45° long-radius ells.

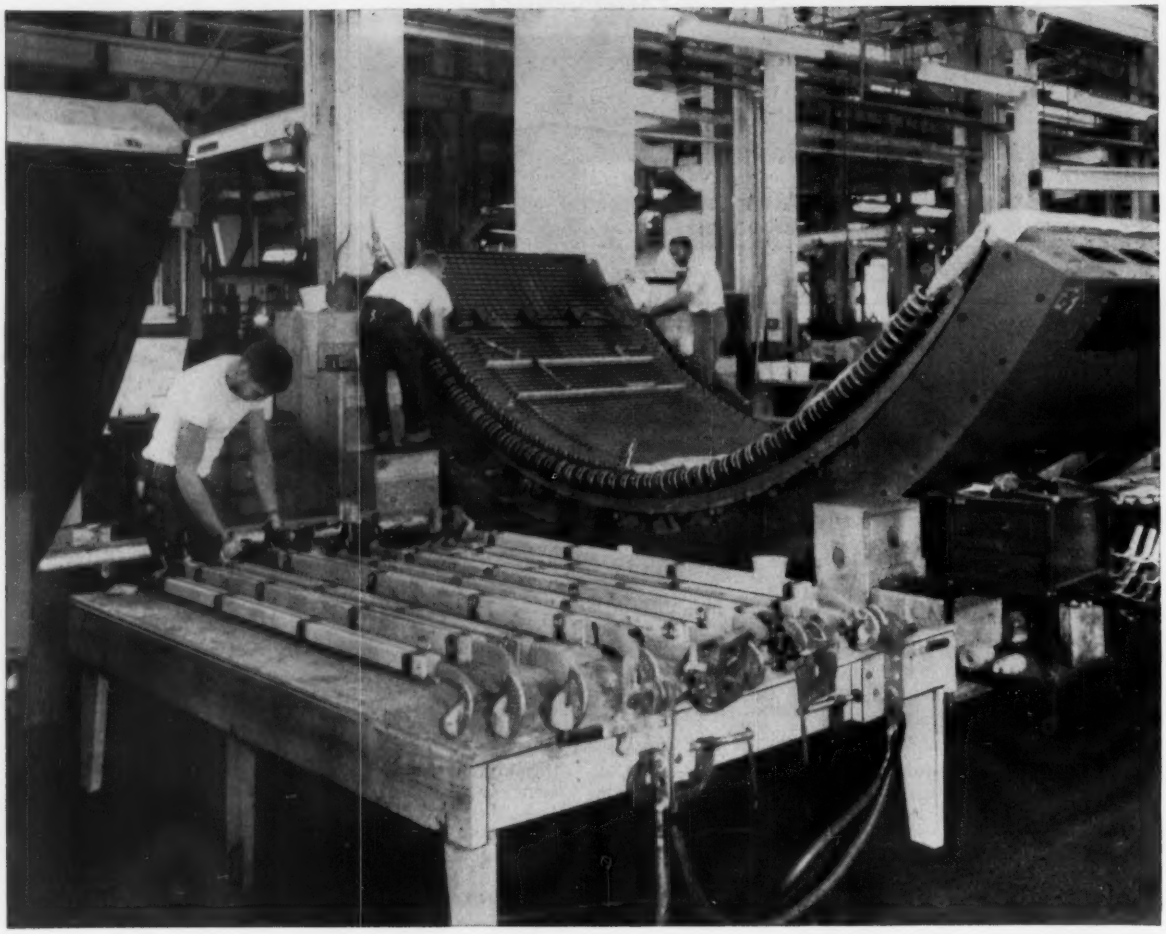
2. EXCLUSIVE LAP-SEAL, available at no extra cost, is a series of 8 ribs rolled into the underlapping edge of jacketing, providing automatic measure of the 2" circumferential lap.

3. FACTORY-ATTACHED MOISTURE BARRIER protects the underside of the aluminum from possible attack by alkaline solutions present in many insulating materials, eliminates the need of applying a separate moisture barrier.

4. CROSS-CRIMP increases strength of jacketing, cuts material cost.

ONLY CHILDERS MAKES AVAILABLE TO YOU COMPLETE SPECIFICATIONS AND ENGINEERING DATA ON ALUMINUM JACKETING IN THESE CATALOGS: SWEET'S INDUSTRIAL CONSTRUCTION FILE PP. 10B/CH; CHEMICAL ENGINEERING CATALOG PP. 1011-1014; REFINERY CATALOG PP. 317-320.

For more facts circle 230 on Reader Service card, p 97



King-size rebuilding job by National

...*The* Specialists in electric coils...repair service

Severely damaged by fire, this 30,000 kva generator required complete rebuilding. Since the fire had warped the stator, it was shipped to National Electric Coil's Columbus plant, where the first job was to remove the laminations and straighten the frame. Damaged laminations were replaced with new ones and the core restacked. Coils, manufactured by National, are shown in the illustration being wound into a section of the stator which was of such size that it was built in thirds to make rail shipment possible.

After thorough testing, the stator was shipped back to the customer, assembled on the site, and the winding lap between each of the sections completed.

Whenever you need service on rotating electric machinery—whether large or small, whether you need a few coils or a complete rebuilding job—contact National Electric Coil. Our service is fast, thorough and guarantees satisfaction.

For more information in the next 2 minutes call National's Columbus plant . . . HUdson 8-1151. Or call the nearest National field engineer.

National Electric Coil

McGRAW EDISON

DIVISION OF McGRAW-EDISON COMPANY

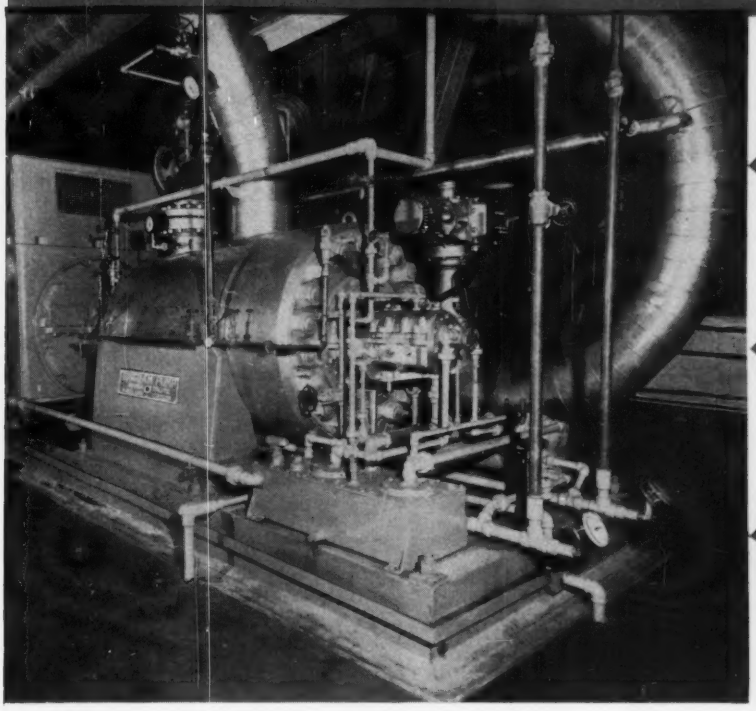
COLUMBUS 16, OHIO

ELECTRICAL ENGINEERS • MANUFACTURERS OF ELECTRICAL COILS, INSULATION, LIFTING MAGNETS • REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

Bingham

"DOUBLE VOLUTE" BARREL TYPE BOILER FEED PUMPS

THE ULTIMATE IN DEPENDABILITY FOR HIGH PRESSURE SERVICE



BINGHAM BARREL TYPE HIGH PRESSURE BOILER FEED PUMPS

PACIFIC POWER AND LIGHT COMPANY
Glenrock, Wyoming

ENGINEERS AND BUILDERS
Ebasco Services, Inc.

Bingham Barrel Type Boiler Feed Pumps, installed in the Pacific Power & Light Company plant at Glenrock, Wyoming. Each pump is designed to deliver 1875 GPM at 2300 PSI, operating at 3560 RPM.

Bingham "Double Volute" Barrel Type Boiler Feed Pumps are furnished with forged outer barrel for high pressure service. Pumps of this type are available for a wide range of capacities and heads. Your nearest *Bingham* office will be glad to give you full details on request.

BINGHAM BARREL TYPE BOILER FEED PUMPS feature:

- "Double Volute" construction.
- Double suction first stage for low NPSH.
- Balanced axial thrust (no balancing drums needed).
- Kingsbury Thrust Bearings.
- Stuffingboxes are arranged for either packing or mechanical seals.
- Stuffingboxes are subjected to suction pressure only.
- Designed for high operating speeds.

Bingham SINCE 1921

DOUBLE VOLUTE PUMPS RADIAL BALANCE

BINGHAM PUMP COMPANY
General Offices: **2800 N. W. Front Avenue, Portland 10, Oregon**
Factories: **Portland, Ore. • Vancouver, B. C., Canada**

SALES AND SERVICE OFFICES

BOSTON, MASS.	NEW YORK CITY, N.Y.
CHICAGO, ILL.	PHILADELPHIA, PA.
CLEVELAND, OHIO	PITTSBURGH, PA.
DALLAS, TEXAS	SAN FRANCISCO, CALIF.
DENVER, COLO.	SEATTLE, WASH.
HOUSTON, TEXAS	ST. LOUIS, MO.
KANSAS CITY, MO.	ST. PAUL, MINN.
LOS ANGELES, CALIF.	TULSA, OKLA.
NEW ORLEANS, LA.	TORONTO, ONT., CAN.
	VANCOUVER, B. C., CAN.

For more facts circle 232 on Reader Service card, p 97

bends like this are easy with...

Republic ELECTRUNITE Boiler Tubing

because uniform ductility is built-in

Uniform ductility of ELECTRUNITE® made a big difference at the power plant installation of Toms River-Cincinnati Chemical Corporation, Toms River, New Jersey.

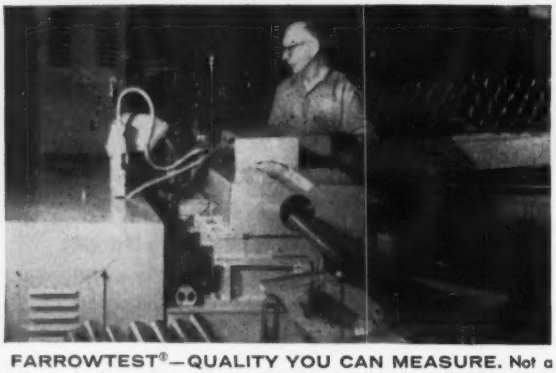
This C-E Boiler, Type VU-50, engineered and erected by Combustion Engineering, Inc., New York City, was designed for maximum operation of 157,000 lbs. per hour at 650°F., with 600 lbs. psi design pressure. Fifty-one tons of Republic ELECTRUNITE Boiler Tubing were used in this unit.

Here, Republic ELECTRUNITE Boiler Tubing met the curvature of the boiler design in a severe test of uniform ductility. Bends were smooth and uniform, fitted easily into the boiler head drum holes. Results: Savings in installation time and costs.

ELECTRUNITE is made of highest quality flat-rolled open-hearth steel produced in Republic's own mills, carefully controlled every step of the way. Full normalizing, uniform wall thickness and diameter, and uniform ductility assure easy workability and in service dependability.

ELECTRUNITE is produced by the exclusive process that ELECTRically-UNITEs the tube under pressure without additional foreign or extra metal. This process is universally accepted by leading technical authorities, code societies, boiler and heat exchanger manufacturers, Federal and State committees.

To learn more about ELECTRUNITE for boiler, heat exchanger, condenser, or evaporator applications, call your Republic representative. Or, write direct.



FARROWTEST®—QUALITY YOU CAN MEASURE. Not a laboratory theory, not a mere inspection tool, but an exclusive production test that detects and rejects tubing containing defects of critical size. FARROWTEST is offered as an alternative to other less positive tests in accordance with table below, at no extra cost.

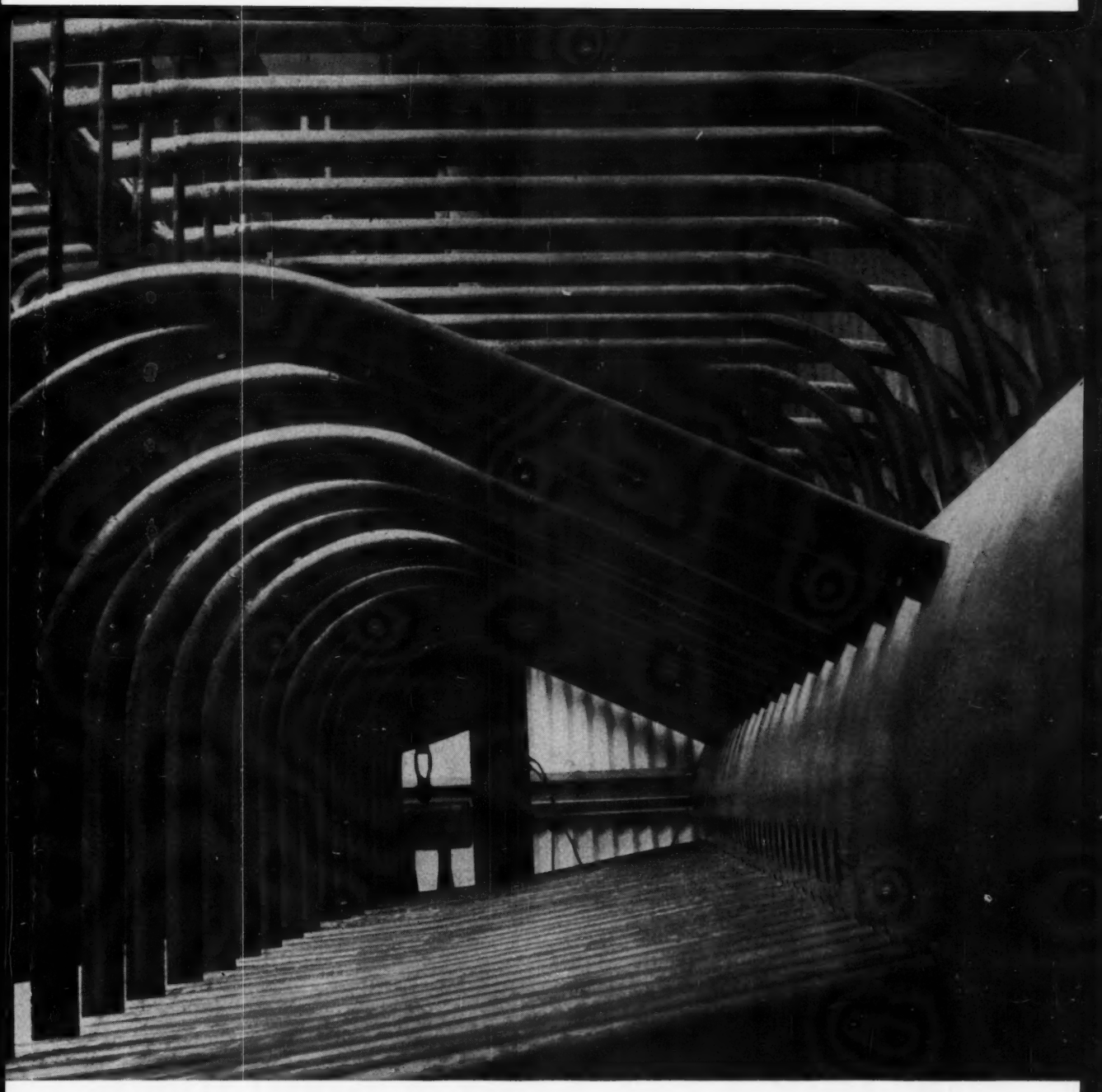
FARROWTEST REJECT TABLE

Wall Thickness (B.W. Gage)	Minor dimension of the defect (Length or Depth)	Defective Area (Length X Depth Plane)
20	.006″	.0025 sq. inches
18	.006″	.003 sq. inches
16	12½% of wall	.003 sq. inches
14 and 13	12½% of wall	.004 sq. inches
12 and heavier	12½% of wall	.005 sq. inches

FARROWTEST detects and rejects not only tubing containing defects which completely penetrate the wall; but also tubing with defects equal to, or greater than, those shown in this table. For irregular defect shapes, a tube with defect area equal to or greater than shown above is rejectable. Where required, sensitivity of FARROWTEST equipment can be calibrated to reject defects of lesser specified area than shown in table, at extra cost.

QUALITY YOU CAN SEE! Republic ELECTRUNITE Boiler Tubing uniform ductility pays off in fit-right installations. Full normalizing and true concentricity assure easier roller expanding. Trouble-free service on the inside is a big factor in savings in installation time and costs.

GOT A WATER PROBLEM? Republic ELECTRUNITE Stainless Steel Heat Exchanger Tubing resists corrosion and provides long trouble-free service for main surface condensers in utility power plants where water is used directly from natural sources. Call your Republic representative, or write direct.



REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

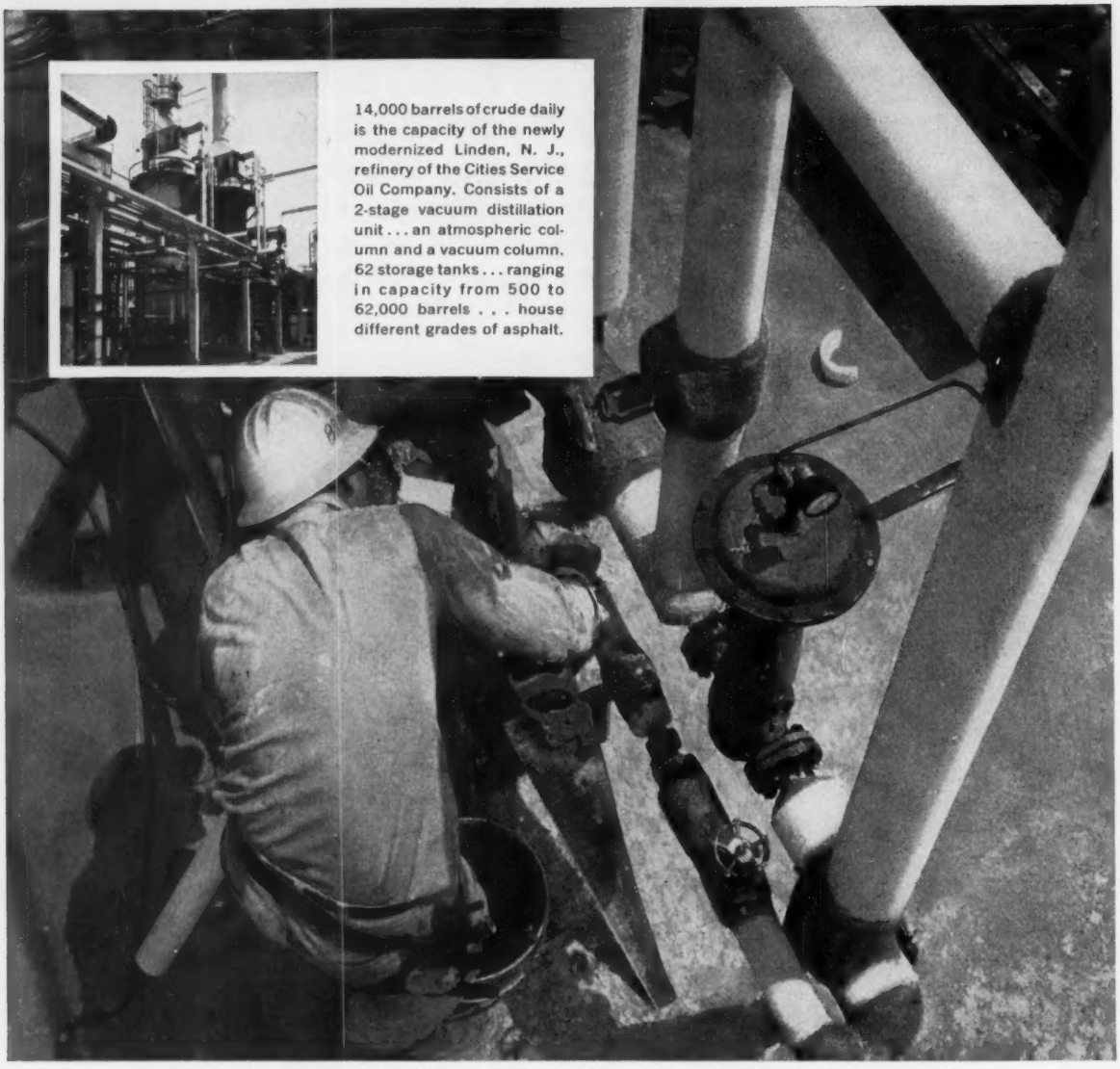
REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION
DEPT. C-7782
221 EAST 131st STREET • CLEVELAND 8, OHIO

Please send additional information on the following products:

☐ Republic ELECTRUNITE Boiler Tubes
☐ Republic ELECTRUNITE Heat Exchanger Tubes
☐ Carbon, or ☐ Stainless ☐ FARROWTEST Brochure

Name_____ Title_____
Firm_____
Address_____
City_____ Zone____ State_____

For more facts circle 233 on Reader Service card, p 97



14,000 barrels of crude daily is the capacity of the newly modernized Linden, N. J., refinery of the Cities Service Oil Company. Consists of a 2-stage vacuum distillation unit . . . an atmospheric column and a vacuum column. 62 storage tanks . . . ranging in capacity from 500 to 62,000 barrels . . . house different grades of asphalt.

138,000 feet of "K&M" KaytherM Block Insulation and 56,000 feet of "K&M" KaytherM Pipe Insulation handle a range of operating temperatures from 90°F. to 700°F.

"K&M" KAYTHERM KEEPS A RIVER OF ASPHALT FLOWING AT NEW CITIES SERVICE REFINERY

You've got to keep asphalt hot in order to keep it moving. And, move it must . . . from distillation unit to storage tank . . . It's outdoor travel . . . where the insulation must be strong and tough enough to withstand the ravages of weather.

That's why you'll find "K&M" KaytherM Pipe and Block Insulation on the job at this modern, new refinery. It's weather-resistant and chemically stable . . . doesn't disintegrate or lose efficiency. Remains highly efficient to 1350°F.

Strong, lightweight, and easy to work, "K&M" KaytherM reduces installation and maintenance costs. You can use it indoors or outdoors for every use.

Write today for more information on this hydrous calcium silicate insulation.

K·M
BEST IN ASBESTOS

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

LOUIS N ROWLEY, EDITOR • MAY 1959 • ESTABLISHED 1882 Power

Planned purchases pay off

For nearly two years, orders for turbines and steam generators have been at low ebb. Now we see growing expressions of concern about the units needed in the early 1960's. Will a belated rush of orders outstrip manufacturing capacity and cause delays in deliveries?

This is the immediate question, and an important one. But it focuses attention on a matter of even greater long-run significance—the "feast or famine" conditions traditionally faced by makers of heavy equipment.

These conditions are highlighted from the boiler manufacturer's point of view in a paper presented at the recent American Power Conference by Carl E Miller of Combustion Engineering, Inc. Since 1949, he points out, major economic indicators have risen dramatically. In contrast to the generally upward curves for gross national product and electrical output, purchases of boilers show a peak-and-valley pattern in terms of millions of lb per hr of steaming capacity. From 60 million in 1949, purchases rose to 192 million, dropped to 78 million, rose again to 225 million and are now down to 62 million.

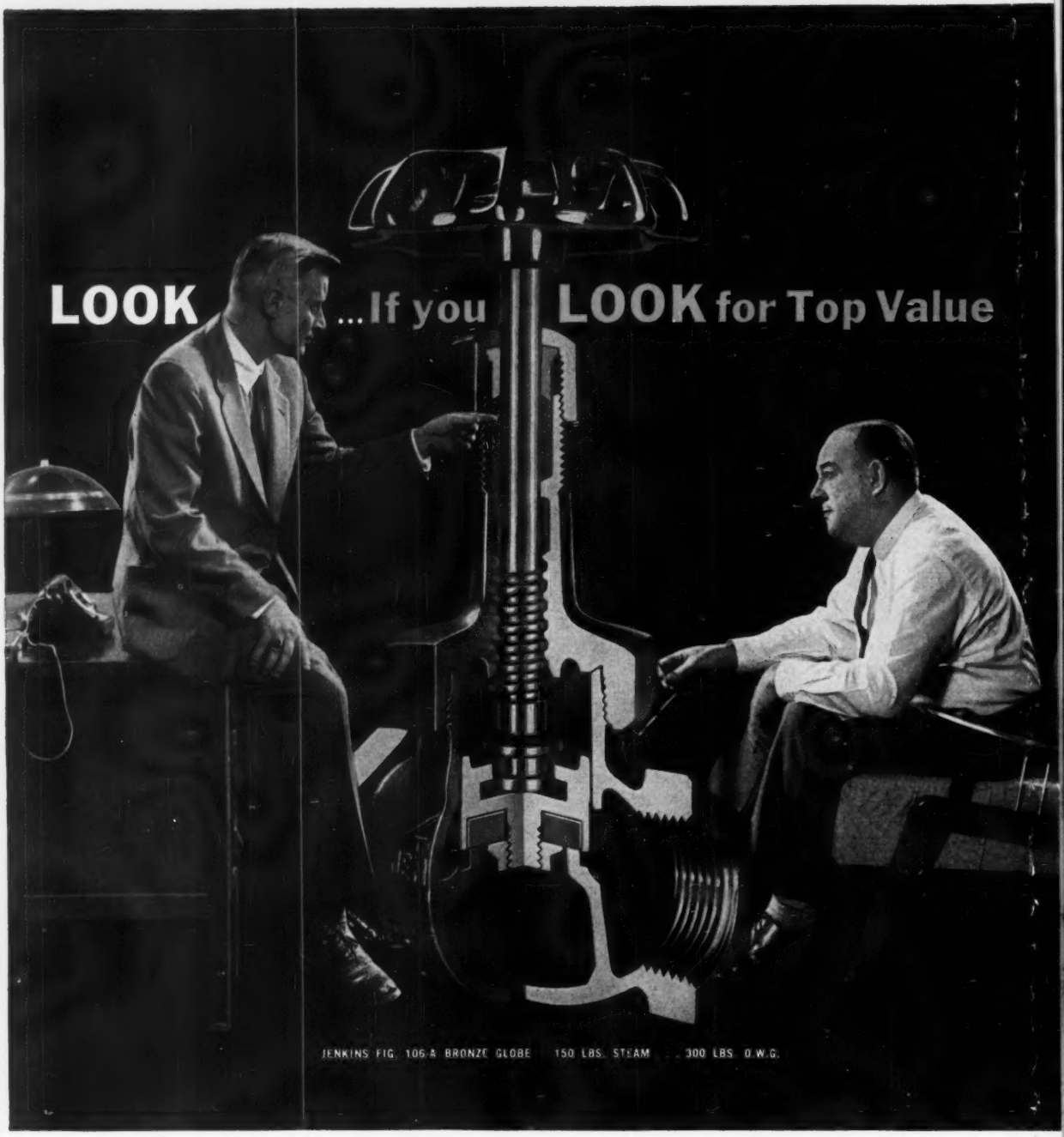
Such fluctuations obviously result in poor utilization of manufacturing capacity, of skilled production workers, and of highly trained engineering staffs. In the long run they are costly to both equipment builder and equipment purchaser.

The remedy, as Carl Miller points out, lies first in carefully analyzing growth trends and the future equipment needs they will mean. Then, instead of placing orders only when sheer necessity dictates, purchases can be spaced out to give the best overall economic results.

Of course no one can afford to consistently install more equipment than is actually needed. But when future needs are known and planned for, orders can often be placed early with advantage. Costs of labor and materials have shown a steadily rising trend; thus buying a year or two ahead will often save on escalation costs, more than enough to offset additional charges on capital investment.

If the unit so purchased is installed ahead of actual need it can handle base load at high efficiency and older, less-efficient equipment can be used for peaks or standby, with resulting savings in operating cost. Or in some cases it may even be worthwhile, says Miller, to place orders early, fabricate the equipment, and store it until needed. Lower escalation costs are again the result and in addition there may be possibilities for saving in erection cost. With all material on the site, erection procedure can be planned on a completely logical basis to minimize expensive field labor.

In these ways, and others, engineers and owners who carefully plan future major equipment needs may find it to advantage to order ahead of actual last-ditch capacity need. And to the extent that they reduce "feast or famine" conditions for manufacturers, they will benefit from lower equipment costs and even better products.



THE FIRST renewable composition disc valve was a Jenkins Valve, originated nearly a century ago. Compare today's Fig. 106-A Bronze Globe with any other. See why so many valve users agree that a *Jenkins* is still the FIRST for top value. For descriptive folder No. 189-B on the full line of Jenkins Bronze Globe, Angle and Check Valves write to Jenkins Bros., 100 Park Avenue, New York 17.

Sold Through Leading Distributors Everywhere

JENKINS VALVES

LOOK FOR THE JENKINS DIAMOND

JENKINS SINCE 1864 Jenkins Bros

in DISC EQUIPPED BRONZE VALVES

LOOK at that Wheel — Tough malleable iron. Design unequalled for cool, sure grip.

LOOK at the Index Plate — Has Fig. No. etched in green background. Held by wheel nut.

LOOK at the Wheel Nut — Secured by rolled-over spindle end. A quality detail.

LOOK at that Spindle — Made of high tensile bronze. See how much heavier it is . . . how many more deeply cut threads engage bonnet. And, the crowned head that reduces friction on disc holder. Sure, it costs more to make a spindle this way. But it reduces wear, preserves packing, means easier operation.

LOOK at the Packing Nut and Gland — Note the heavy and deep bronze hex. And, that bronze gland designed to compress packing toward spindle.

LOOK at that Packing Box — Its depth equals 1½ times spindle diameter. More packing space means less repacking. An asbestos, lubricated and graphited packing is used.

LOOK at that Bonnet — One-piece, screw-over design with big hex surfaces is easy to remove. Take an extra look at the bevel joint between bonnet and body, serving as an internal brace against the crushing effect of the bonnet assembly. Millions of Fig. 106-A in use for years prove this unique design licks distortion and springing.

LOOK at the Disc Holder — It's the Slip-on Stay-on type originated by Jenkins. Correct protective depth prevents flaking or cracking of disc.

LOOK at the Disc — Easily renewed without removing valve from line. Made of compositions to suit various services . . . and *made by Jenkins*, the only maker of both valves and discs.

LOOK at that Body — Just compare wall thickness of this high tensile bronze body with any other valve. The factor of safety is many times higher than rating requires. See the curved diaphragm to protect seat from distortion by pipe strain. Note that the raised seat is higher to permit more reseating operations . . . and wider, so it won't cut into disc. Pipe threads are full length and clean cut.

LOOK at this . . . for Throttling — Just replace the disc nut with this Throttling Nut and a Fig. 106-A becomes well-suited to throttling service. This unique nut reduces the effects of wire drawing and its long legs restrict flow for accurate control. Many plants take advantage of this versatile valve to reduce valve and parts inventory.

For more facts circle 235 on Reader Service card, p 97

6 Ton Hot Reheat Header

Model test set-up of hot reheat line as reproduced above is approximately 1/10th actual size of the model. Circled area shows position of chrome-moly header in the line.

Size of this hot reheat header can be seen by comparison with men in the picture. It is 21" O.D., fabricated of 2¼% chrome, 1% molybdenum steel.

PRETESTED and PREFABRICATED by Pittsburgh Piping

PART OF A COMPLETE HIGH-PRESSURE, HIGH-TEMPERATURE PIPING SYSTEM

The model shown above exactly duplicates—from an engineering standpoint—a hot reheat line which is part of a high-pressure, high-temperature piping system fabricated by Pittsburgh Piping.

The inset shows the position and relative size of the header in the line, and the main illustration is an actual photograph of this header as fabricated in our shops. The complete system, which includes chrome-moly and stainless steel piping fabrication, is one of scores of installations which we have model-tested, fabricated, and erected.

Use this experience on your next piping job . . . electric generating station, nuclear power installation, chemical processing plant, refinery, mill, or factory. We are specialists with complete facilities, and we assume responsibility for every phase of the work—from blueprint through erection.

Promoting Progress ***IN POWER AND PROCESS PIPING***

Pittsburgh Piping AND EQUIPMENT COMPANY
158 49th Street • Pittsburgh 1, Pa.

Canada: **CANADIAN PITTSBURGH PIPING, LTD.,** 68 YONGE STREET—TORONTO, ONTARIO

Atlanta.....Whitehead Building
Chicago.....Peoples Gas Building
Cleveland.....Public Square Building
New Orleans.....P. O. Box 74
New York.....Woolworth Building

PP-36

For more facts circle 236 on Reader Service card, p 97

Design and equipment application section

B G A SKROTZKI
Associate Editor in Charge

OLD AND NEW illumination in bookbindery: 160 foot-candles used in front area, 40 in rear

Engineered lighting moves ahead

- Recent research on how much light we need puts evaluation of industrial lighting on a more accurate basis. Result is higher recommended foot-candle levels

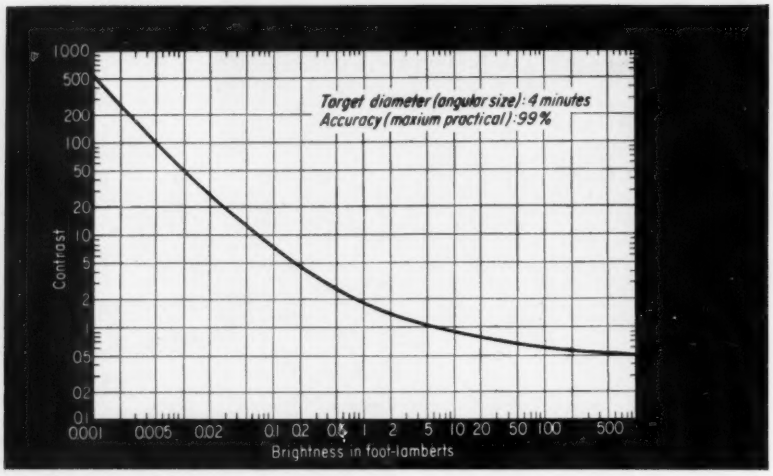
- High-output fluorescent lamps have been given boost as way to meet upgraded illumination levels; at the same time mercury is finding wider application

- Answer to some high-output problems is high frequency. Breakthrough in h-f limitations appears to be transistor converter slated to go into production

continued

By NORMAN PEACH
Associate Editor

INDUSTRIAL TASK SIMULATOR tests visual perception in terms of contrast, speed



FIELD-USE CURVE shows brightness required for the task with a given contrast between areas to be distinguished. Actual field tasks can be related to "target" by optical device

Visual research offers answer to how much light

Lighting engineers have felt a need for more precise ways to find out what the eyes require for specific tasks. With the publication of the Blackwell report last summer this need has to a considerable extent been met. Dr H R Blackwell and his associates, working at the U of Michigan (and now at Ohio State) under sponsorship of Illuminating Engineering Research Institute in association with Illuminating Engineering Society, devised methods for measuring visual performance and related them to specific seeing tasks. Important work, of course, has been done previously in this field by other investigators, and much remains to be done. But the Blackwell report, with the authority of IES, should go a long way toward establishing a standard procedure for determining illumination needs. First results are new recommendations for foot-candles; tables are in the latest edition of the IES *Handbook*. Typical industrial recommendations are on opposite page. (Compare these with older values in *Industrial Lighting*, POWER Special Report, June 1956 to see how thinking changed.)

Lab setup Blackwell used was a large cubicle with white interior indirectly lighted. A test spot of light, or *target*, was projected from behind on a translucent screen. Difference in brightness between the spot and background was compared with background brightness; this ratio is called *contrast*. The brightness of the background and of target were varied as was time in which target was present.

Apparent size of a target, and in fact any object we see, depends both on its actual dimensions and on its distance from the eye. Visual researchers express size as the angle formed at the eye by the extreme dimension of the object. A circular target is thus an ideal visual object.

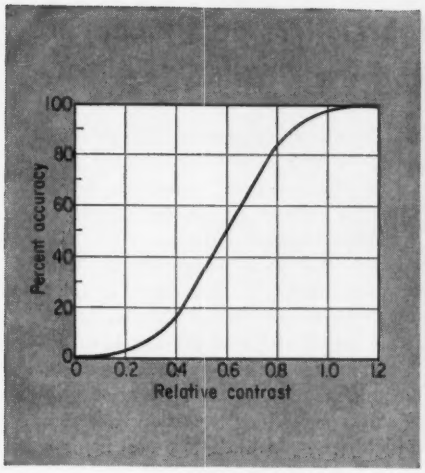
Observers pressed a button each time they distinguished the target. Comparing the number of responses with actual number of times target appeared, it was possible to establish a figure for accuracy of visual perception. Results of varying contrast, background brightness, angular size and time target was present are shown in curves, top right.

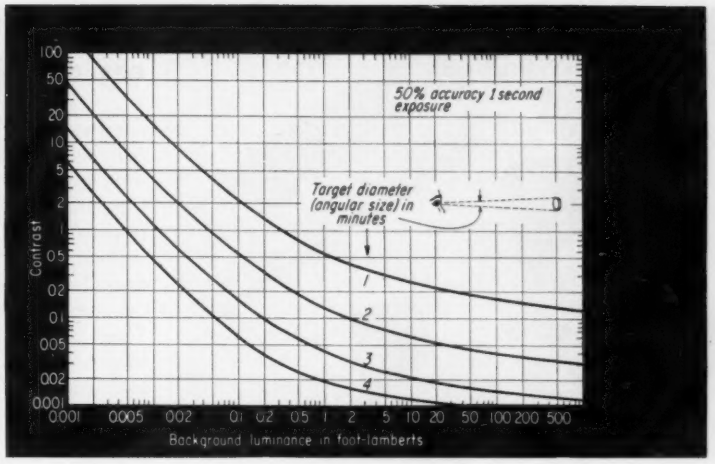
Field conditions don't always match static lab conditions, so Blackwell devised the *field task simulator*, photo, above. An 8-ft wheel with 50 plastic disks on its perimeter rotates to produce action equivalent to a belt conveyor's. Among the 50 disks are three to six which have circular defects in the center, and when the observer recognizes one of these she presses a button. Test results indicated that to compensate for field conditions static lab contrast must be multiplied by a factor of 15.

Next step was to relate data obtained from test disks with centered circular defects to practical objects with complex, irregular shapes. To this end Blackwell and his associate B S Pritchard devised an optical arrangement called a *visual task evaluator*. The practical object is viewed through an eye-piece. A veiling brightness is increased until it washes out details and brings the configuration to threshold visibility. After this another set of optics is used to bring a 4-minute disk into view, which in turn is reduced to the threshold of being seen. Comparing the two brightness values at threshold conditions, the contrast is obtained. When you know the contrast you can refer to the field-use curve above and find brightness needed to see practical object under dynamic field conditions.

The Blackwell report contains other important information on how the eye works in performing visual tasks. In the next few years continued research will show us ways to use our eyes more efficiently and more safely.

continued on page 54





ACCURACY of recognition between contrasting areas is found to closely follow the curve

VISUAL CAPACITY is here measured giving eye one second to distinguish target. Target diameter is in minutes of visual angle; it depends on size, distance

we need to see efficiently in an industrial plant

Typical recommended illumination levels in foot-candles

Automobile manufacturing	
Assembly line	200
Frame assembly	50
Body manufacturing	
Parts	70
Assembly	100
Finishing and inspecting	200
Chemical works	
Hand furnaces, boiling tanks, stationary driers, stationary and gravity crystallizers	30
Mechanical furnaces, generators and stills, mechanical driers, evaporators, filtration, mechanical crystallizers, bleaching	30
Tanks for cooking, extractors, percolators, nitrators, electrolytic cells	30
Elevators—freight and passenger	20
Forge shops (and welding)	50
Foundries	
Annealing (furnaces)	30
Cleaning	30
Core making (fine)	100
Core making (medium)	50
Grinding and chipping	100
Inspection (fine)	500
Inspection (medium)	100
Molding (medium)	100
Molding (large)	50
Pouring	50
Sorting	50
Cupola	20
Shakeout	30
Iron and steel manufacturing	
Motor room, machine room	30
Open hearth	
Charging floor	20
Slag pits	20
Control platforms	30
Hot top	30
Stripping yard	20
Calcining building	10
Rolling mills	
Blooming, slabbing, hot strip	30
Cold strip, plate	30
Pipe, rod, tube, wire	50
Merchant and sheared plate	30
Tinning and galvanizing	50
Tin-plate cold-strip rolling	50
Inspection	
Backplate, billet chipping	100
Tin plate, bright surfaces	100
Loading platforms	20
Machine shops	
Rough bench and machine work	50
Medium bench and machine work, ordinary automatic machines, rough grinding, medium buffing, polishing	100
Fine bench and machine work, fine automatic machines, medium grinding, fine buffing	500
Extra-fine bench and machine work, grinding, fine work	1000
Oil-storage tanks	1
Paper manufacturing	
Beaters, grinding, calendering	30
Finishing, cutting, trimming	50
Paper-machine reel	100
Parking areas	5
Plating	30
Polishing and burnishing	100
Power plants, engine room, boilers	
Boiler room (operating floor)	10
Chemical laboratory	50
Coal bunker (conveyor floor)	10
Coal-crusher house	10
Condenser pit (turbine room)	10
Control rooms (on vertical plane)	30-50
Heater gallery	10
Precipitators	10
Tunnels or galleries, piping	10
Turbine-bay sub-basement	20
Conveyors (outdoor)	2
Substations	2
Switchgear area	20
Turbine room (operating floor)	30
Steam headers and throttles	10
Water-treating area	20
Sheet metal works	
Misc machines, ordinary bench work	50
Punches, presses, shears, stamps, spinning, medium bench work	50
Tin-plate inspection	200
Stairways, passageways	20
Storage and stock rooms	
Rough bulky material	10
Medium	20
Fine material requiring care	50
Warehouse	5

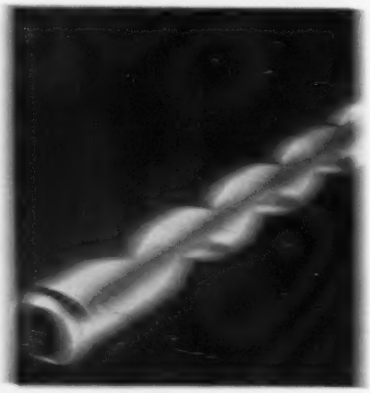
Simpler, lighter, less costly converters aid progress of high frequency

Expanded use of high-output fluorescent lamps stimulates reduction of ballast size and weight. Substantial reduction is possible with high-frequency capacitive ballasts. Containers for 1500-cps ballasts are compared with corresponding 60-cps ballasts in photo, left.

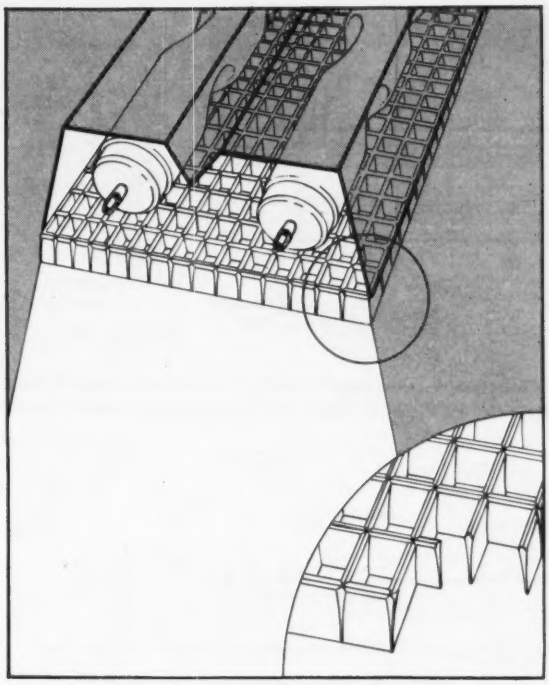
Recently converters have been improved in design, some have been reduced in price. Still favorite are the motor-generator sets with frequencies of 420 and 840 cps. These have relatively low initial cost per kw, have good efficiencies and are familiar in design, but need some maintenance. Top units available (420 cps) are 100 kw. Transformer type static converters need negligible maintenance and have high efficiency, but initial cost is higher. You can get them in 5 and 25 kw, both 360 cps.

A transistorized converter now in trial operation may be the most successful approach. Projected converters are small (top of photo, left); one unit is rated 125 kw, 1500 cps, 108 v, at 94% full-load efficiency. They're built for mounting near but not on luminaires. Mass production of rugged transistors will bring cost down. Looking into the future, it seems likely that individual transistor converter will be part of ballast installed in luminaire.

Improved light sources with longer lamp life are



Fluorescent lamps achieve high lumen output . . .



Quality requirements for new illumination levels stimulate better control

Luminaire makers are finding better ways to get maximum light efficiency without excessive luminaire brightness. This may mean trend toward large-area luminaires. Shielding grid, left, goes all out for low luminaire brightness, gets good efficiency with reflecting parabolic grid walls. Material is metalized plastic. Luminaire might be used for an industrial inspection area. Other types of shielding, including prismatic, are being applied.

Checking table on p 53, you'll see that highest footcandle values aren't for general lighting but are intended for specific seeing tasks. This may well mean more supplementary lighting, combined with good general lighting. Rules of brightness ratio remain: 3 to 1 for foreground, 10 to 1 for background.

Interest in quality today is emphasized by the growing importance of consulting engineers who specialize in lighting. Architects and contractors are realizing it takes an expert to specify good lighting.

Maintenance is getting a growing share of respect, too. Companies that specialize in maintaining lighting systems are so widespread that they have their own national association. Group relamping has gained some ground.

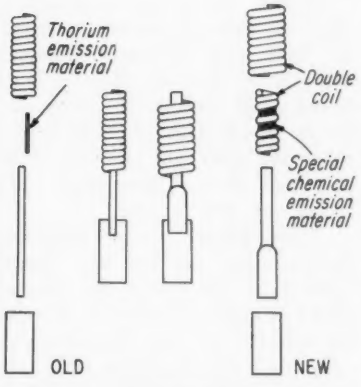
meeting challenge of higher illumination levels

than fluorescent, and is maintained longer. Better optical control is possible on high-bay installations. Latest mercury lamps have very long life—10,000-hr rated average life for some types. Like fluorescents, highest output is obtained with white. Mercury lamps today offer good color choice; available are: (1) clear; that is, without fluorescent coating but possibly frosted (2) improved white; improved color by phosphor coating (3) standard white with maximum efficiency phosphors (4) extra improved color. Reflector-lamp use has been growing for dirty, inaccessible applications to simplify maintenance.

There are advantages to operating mercury lamps at 460-480 volts in sizes designed for this voltage. Ballasts can be simple choke type which results in big savings. Choke-capacitor ballast can be used with 265-277 volts, but is not as advantageous as 460-480 ballast.

Filament improvements have given incandescent lamps better lumen maintenance, and several manufacturers have brought out lamps with extra long life. These may be a good buy for locations that are costly to service. Claims of extremely long life should be looked at closely, however, to see how efficiency falls off with age and lumen output drops.

Electroluminescence for lighting is still in the future, but it will probably soon arrive in the plant for indicators and annunciators. A recently developed panel which spells out instructions using an electroluminescent letter grid has many application possibilities. Units are claimed to be impervious to contaminants, can take vibration, wide thermal range.

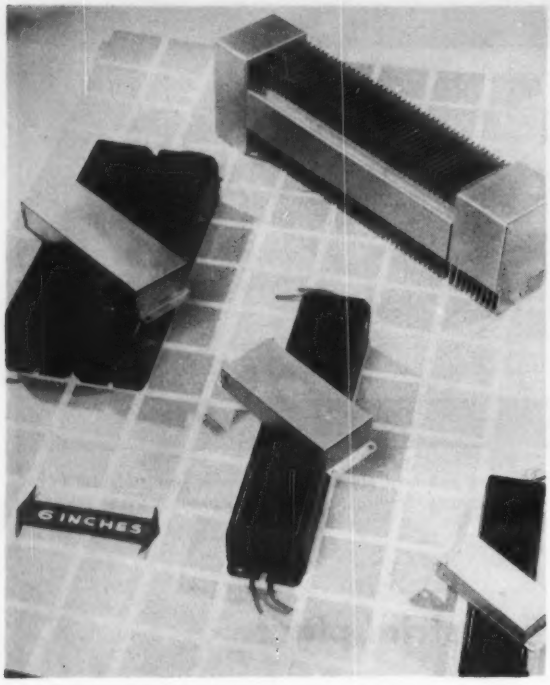


Mercury cathodes . . .

now use compounded "chemical" emissive material to extend lamp life substantially

Reprints available

Reprints of this *TD* report are available to *Power* subscribers without charge until June 1, 1959. To order, write *TD Reprint* on Reader Service card, p 97. Charge to nonsubscribers is: 25c each for orders under 25 copies; 20c each on orders for 25 to 50 copies; 15c each on orders for more than 50 copies.



Simpler, lighter, less costly converters aid progress of high frequency

Expanded use of high-output fluorescent lamps stimulates reduction of ballast size and weight. Substantial reduction is possible with high-frequency capacitive ballasts. Containers for 1500-cps ballasts are compared with corresponding 60-cps ballasts in photo, left.

Recently converters have been improved in design, some have been reduced in price. Still favorite are the motor-generator sets with frequencies of 420 and 840 cps. These have relatively low initial cost per kw, have good efficiencies and are familiar in design, but need some maintenance. Top units available (420 cps) are 100 kw. Transformer type static converters need negligible maintenance and have high efficiency, but initial cost is higher. You can get them in 5 and 25 kw, both 360 cps.

A transistorized converter now in trial operation may be the most successful approach. Projected converters are small (top of photo, left); one unit is rated 1.5 kw, 1500 cps, 108 v at 94% full-load efficiency. They're built for mounting near but not on luminaires. Mass production of rugged transistors will bring cost down. Looking into the future, it seems likely that individual transistor converter will be part of ballast installed in luminaire.

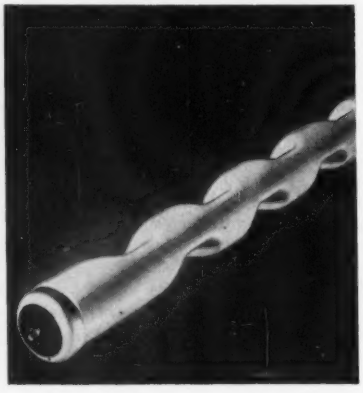
Improved light sources with longer lamp life are

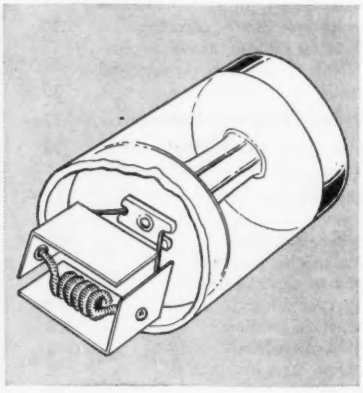
Fluorescent lamps with high lumen output, now popular, are expected to solve many of the problems of providing the new illumination levels. Latest 1500-ma 8-ft tubes deliver 1500 lumens with proper ballasts and luminaires and have economic life of 5000 hours. High-output lamps must be spaced properly to give uniform illumination level. If they are used to reduce number of luminaires at low mounting, poor light distribution may result. Color is cool white. Growing application is mixing with mercury to provide light during mercury's dark restarting period. Because of lumen output and long life they're better for this service than incandescent.

Two basic designs are illustrated at right. Recent contour changes of noncircular type have improved performance and reduced weight of glass. Pressure-chamber type uses standard *T-12* tube. Cathodes of both types have received a lot of attention to insure long dependable life and reduce tube-end blackening. With high wattages, you may have heat-removal problems in closed areas (usually not in general industrial lighting).

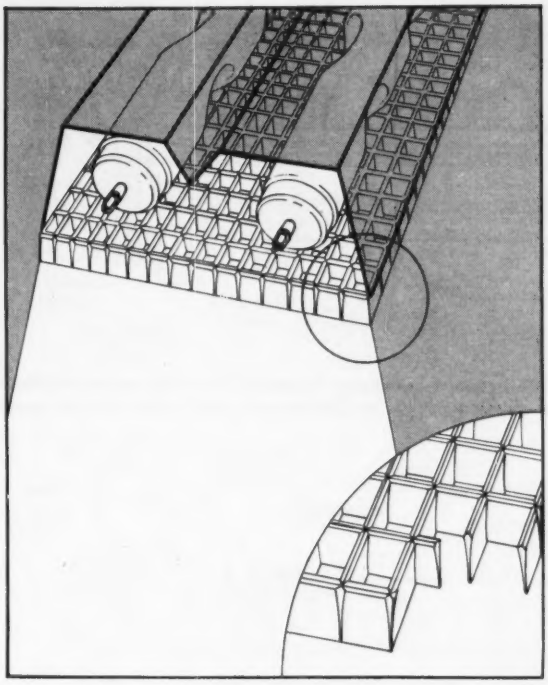
Lamps based on new concept—a thin glass block—are in research stage. The arc travels through labyrinth of passages of glass block to produce, in effect, a large-area source. U-shaped tubes are considered, too.

Mercury may be pulled into wider use by emphasis on high output. In some cases lumen output is higher





Fluorescent lamps achieve high lumen output . . . by two methods. Specially shaped tube brings arc close to fluorescent material, above, left. Cooling chambers at tube ends regulate mercury gas pressure, above, right



Quality requirements for new illumination levels stimulate better control

Luminaire makers are finding better ways to get maximum light efficiency without excessive luminaire brightness. This may mean trend toward large-area luminaires. Shielding grid, left, goes all out for low luminaire brightness, gets good efficiency with reflecting parabolic grid walls. Material is metalized plastic. Luminaire might be used for an industrial inspection area. Other types of shielding, including prismatic, are being applied.

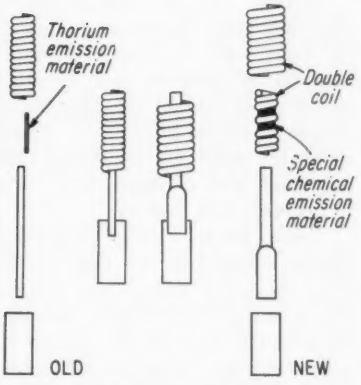
Checking table on p 53, you'll see that highest footcandle values aren't for general lighting but are intended for specific seeing tasks. This may well mean more supplementary lighting, combined with good general lighting. Rules of brightness ratio remain: 3 to 1 for foreground, 10 to 1 for background.

Interest in quality today is emphasized by the growing importance of consulting engineers who specialize in lighting. Architects and contractors are realizing it takes an expert to specify good lighting.

Maintenance is getting a growing share of respect, too. Companies that specialize in maintaining lighting systems are so widespread that they have their own national association. Group relamping has gained some ground.

meeting challenge of higher illumination levels

than fluorescent, and is maintained longer. Better optical control is possible on high-bay installations. Latest mercury lamps have very long life—10,000-hr rated average life for some types. Like fluorescents, highest output is obtained with white. Mercury lamps today offer good color choice; available are: (1) clear; that is, without fluorescent coating but possibly frosted (2) improved white; improved color by phosphor coating (3) standard white with maximum efficiency phosphors (4) extra improved color. Reflector-lamp use has been growing for dirty, inaccessible applications to simplify maintenance.



Mercury cathodes . . .

now use compounded "chemical" emissive material to extend lamp life substantially

There are advantages to operating mercury lamps at 460-480 volts in sizes designed for this voltage. Ballasts can be simple choke type which results in big savings. Choke-capacitor ballast can be used with 265-277 volts, but is not as advantageous as 460-480 ballast.

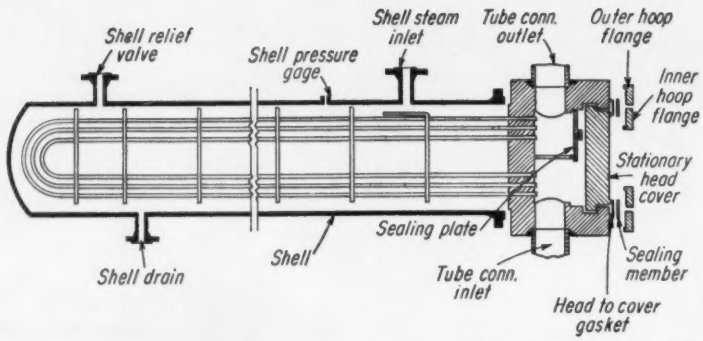
Filament improvements have given incandescent lamps better lumen maintenance, and several manufacturers have brought out lamps with extra long life. These may be a good buy for locations that are costly to service. Claims of extremely long life should be looked at closely, however, to see how efficiency falls off with age and lumen output drops.

Electroluminescence for lighting is still in the future, but it will probably soon arrive in the plant for indicators and annunciators. A recently developed panel which spells out instructions using an electroluminescent letter grid has many application possibilities. Units are claimed to be impervious to contaminants, can take vibration, wide thermal range.

Reprints available

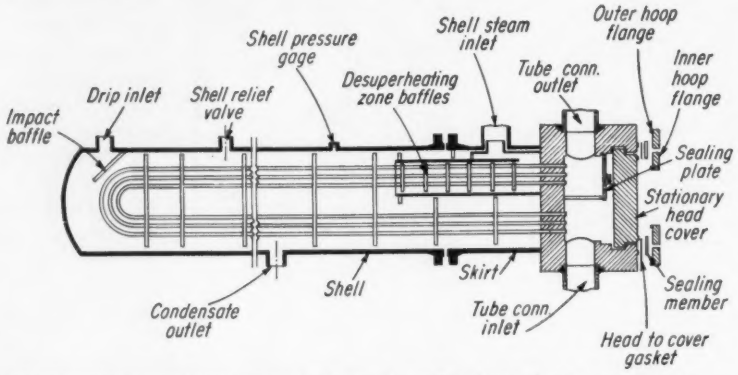
Reprints of this *TD* report are available to *Power* subscribers without charge until June 1, 1959. To order, write *TD Reprint* on Reader Service card, p 97. Charge to nonsubscribers is: 25c each for orders under 25 copies; 20c each on orders for 25 to 50 copies; 15c each on orders for more than 50 copies.

By RAY CLAPPER
Chief Service Engineer
The Griscom-Russell Company



STRAIGHT CONDENSING feedwater heater may be used in horizontal or vertical (head up or down) positions with low-pressure or high-pressure steam, has simplest layout

Central station design advances by improving all the plant components. Even the seemingly static feedwater heater plays an important role in the station betterment parade. Years of experience show...



CONDENSING-DESUPERHEATING feedwater heater has desuperheating zone to raise outlet-feedwater temperature above saturation temperature of steam in condensing section

How operating problems guide design

Feedwater heaters must transfer heat from steam to water efficiently. The tubes and baffles distribute the steam uniformly without an unduly high velocity. Condensate drains freely from the shell and the air and gases vent to a lower pressure region. Skillful design prevents tube vibration, provides ample strength in all parts, assures tight joints and eases inspection, cleaning and renewal of parts.

Arrangement. Depending on space available, heaters may be mounted horizontally, or vertically either head up or down. Two-pass tube designs need a long shell of small diameter while 4-pass tube designs use a shorter shell of larger diameter.

Until recently feedwater heaters had straight tubes between stationary and floating-head tube sheets. This required a large-diameter shell to withdraw the tube bundle. This design had an internal flanged joint at the floating head and twice the number of tube joints used in modern U-tube heaters.

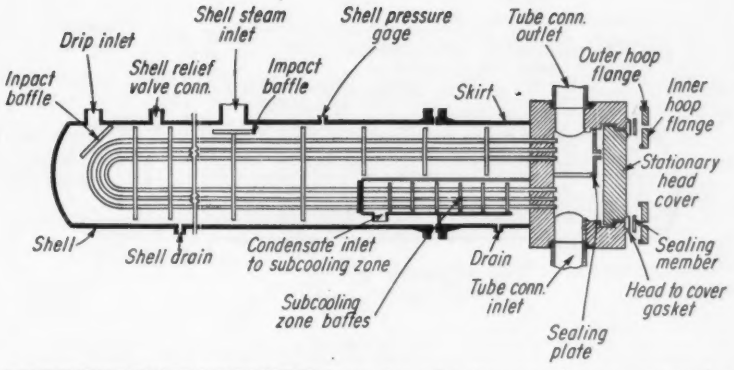
Modern design. Tubes are now available in 80-ft lengths making it easy to produce the modern U-tube construction without welding the tubes. Water conditioning eliminates deposits on tube surfaces in most cases. If it is necessary, the tubes can be cleaned chemically in U-tube heaters.

Tubes can be bent accurately to fit the baffles. The ASME Code specifies the tube-wall thickness with allowances made for thinning of the outside bend of the tube wall—usually about one gage thickness. Tube sizes range from 5/8 to 3/4-in. OD. This gives a more economical heater, considering both size and performance.

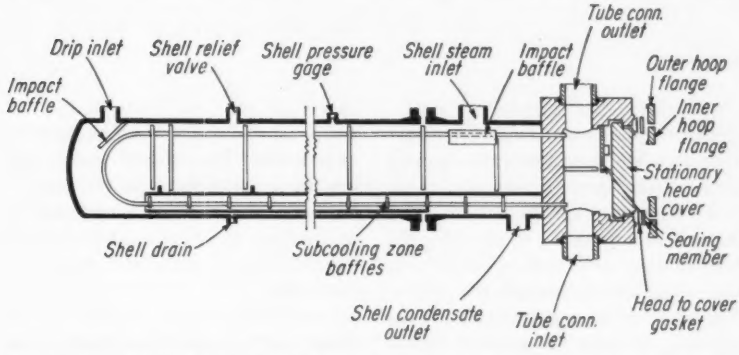
Metals. For moderate pressures, admiralty metal is generally preferred. To limit wall thickness a stronger material is used in high-pressure heater tubes—one of the cupro-nickel alloys: 90-10, 80-20 or 70-30. Monel tubes are used for pressures 3000 psig and above; these have 70% nickel and 30% copper.

Tube joints. Roller expanding fastens tubes into the tube sheets. Tube holes are drilled and reamed with a minimum of 0.008 in. between the tube OD and hole ID. Electronically controlled expanders reduce the tube-wall thickness from 5 to 7% in the area of heavy rolling.

For very thick tube sheets (10 to 12 in.) the tube end is first expanded lightly through the entire



CONDENSING-SHORT-SUBCOOLING heater has subcooling zone that concentrates leaving condensate around the entering section of feedwater tubes to cool it below saturation



CONDENSING-LONG-SUBCOOLING heater has subcooling zone that allows using heater in horizontal or vertical head-up positions with steam forcing condensate to the outlet

# of feedwater heaters

depth of the tube sheet, closing the area between the tube wall and hole to avoid crevice corrosion. The final heavy rolling extends to a depth of about 3 in., or one-half the tube-sheet thickness, whichever is less. Two parallel grooves ⅛-in. wide and 0.02-in. deep machined into the tube holes insure tightness. When customer's specifications require it, tubes can be welded to tube sheet.

Tube experience. Tube welding and shell-joint welding have been specified on the assumption that all feedwater heater troubles consist of gasket joint and tube joint leakage. We have found most troubles caused by tube-wall failure. Despite present testing methods small defects in tube walls have escaped detection and led to trouble.

In a h-p heater one defective tube may destroy up to ten neighboring tubes by the cutting action of the high-pressure water jet escaping through the defect. To repair the damage the head and possibly the shell must be opened. With a welded construction this is difficult and costly. Reassembly for some shell pressures involves local stress relieving and an X-ray inspection of the new welds.

Installation. Heaters should be attached firmly to solid foundations not subject to high-frequency vibrations. These might cause severe tube wear at the support plates even with close-clearance holes.

There must be enough floor clearance to withdraw tube bundle or remove the shell from the tube bundle. For horizontal h-p heaters we prefer to move the shell from the bundle, using support brackets with car wheels. Weight of the forged-steel water head (as high as 20 tons) should be anchored to its support plate and the feedwater piping welded to the nozzles. Ideally, we then move the shell rather than the bundle.

Special provisions should be made for handling the unit in place. There must be enough room around the shell and water-head flanges to handle wrenches for working on the bolts.

Piping should be aligned to avoid unnecessary stresses or additional weight on the nozzles of the shell and water head. Allowance must be made for thermal expansion of the entire unit—some units are 40 ft long.

Gasketed joints. For gasket pressures to 400 psi we usually use 1/32-in.-thick compressed-asbestos-fiber gasket material. For higher shell pressures we use a corrugated soft-iron gasket. For stationary head pressures above 400 psi we use a 1/16-in.-thick soft solid-copper gasket.

The internal gasketed joint underneath the pass partition sealing plate uses a jacketed asbestos-filled type. External gasketed joints have high tensile alloy bolt material. When assembling bolts in the flanges extreme care should be used to distribute the pressure evenly on the gasket and to have enough tension in the bolting to take care of unusual stresses.

In spite of careful assembly of h-p heaters, leakage might develop at a gasket joint. For convenience, leave all external gasketed joints exposed for about three weeks after first starting the unit. Each joint should be checked and retightened as needed. Don't tighten any bolts while the heater is under operating pressure.

Insulation. Never apply insulation to flange joints or head closures until after unit has been run and the gasketed joints checked for tightness. Applying insulation beforehand makes it impossible to follow up on the bolts. Also, gasket leaks cannot be detected until water soaks through the lagging. By this time the gasket face on the flange has usually been steam or water cut and the joint must be repaired. This may involve removing the shell or the tube nest, replacing the gasket and repairing the damaged surfaces.

Before startup, good practice insulates the shell to within several inches of each side of the flange—far

enough away so bolts may be removed. This has the advantages of: (1) keeping the entire flange and gasket cooler (2) showing up gasket leaks soon enough to avoid replacing gaskets or refinishing surfaces (3) allowing bolt tightening without any danger of damaging the insulation.

Where needed, a thin sheet-metal or woven-wire housing could be placed over the joint. It should be designed for easy removal for inspection and bolt tightening. Slight heat loss from the exposed flange is negligible compared to replacement cost of a leaking gasket.

Air venting. Unless the feedwater piping is self venting, heater heads usually have air vents to bleed off air during starting. Heater shell air vents prevent air and noncondensable gases from accumulating. These would reduce heater capacity and cause corrosion.

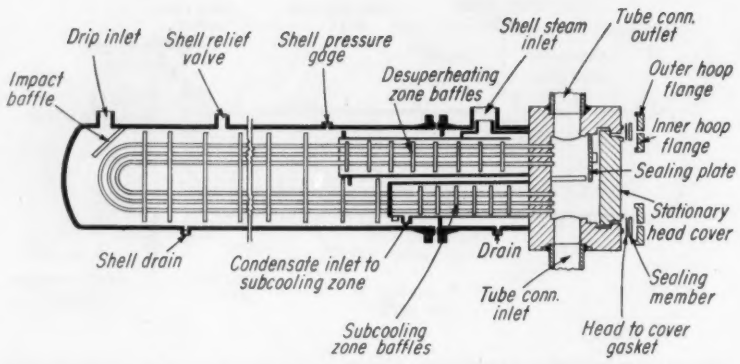
Each heater shell should be vented continuously under control of a properly sized orifice. Vents usually cascade to the next lower pressure heater and are disposed of in the deaerating heater or main condenser.

We recommend venting a steam-air mixture flow to equal about 1/4% of the heater full-load steam flow. This will be satisfactory in all but the most severe cases of steam binding. Cost of this small steam loss from the heater is negligible compared to the potential cost of replacing corroded heater internals.

Lack of venting h-p heater shells will not markedly affect capacity. But venting is a must for l-p heaters at or below atmospheric pressure. Poor venting cuts water outlet temperature.

Location and number of vents will be determined by internal construction of heater and location of steam connection. A properly sized orifice should be located in each vent line as it leaves the heater shell. Vent lines should then join together into a single line connected directly to next heater or main condenser, as straight as possible with a minimum of fittings. In operation this line should be wide open since the orifice control depends on the total differential between the heater-shell pressure and vent-line pressure.

Improper air venting can curtail heater performance by blanketing much of the tube surface with noncondensable gases. Always check the venting when your feedwater heater's performance drops.



CONDENSING-DESUPERHEATING-SHORT-SUBCOOLING heater uses three heat-transfer sections for maximum efficiency; may be used horizontally or vertically with head down

Drainage. Improper drainage reduces heater capacity by flooding the tube surface, or it wastes heat by letting steam blow through the heater. The shell drain regulator should be adjusted to hold the marked heater water level when the heater runs under full load. Simplest control, an external ball-float trap, maintains a level inside the heater and prevents steam blowing through. This should be used only on straight condensing heaters.

An air-actuated level controller gives more positive regulation. The heater arrangement will determine the type of level controller best suited. Heaters with internal subcooling zones must have their water levels held properly. Lowering the water level only a few inches exposes the zone end and destroys its effectiveness. Raising water level too high floods the condensing surface and lowers capacity; this is especially critical in horizontal heaters where a slight rise covers a large percentage of the surface. For close regulation the level controller should have an automatic reset mechanism designed to hold a fixed water level independently of load on the feedwater heater.

Heaters must have adequate hotwell volume either internally or externally for the drain-control valve to operate dependably without large level fluctuations as load changes. The valve must also have ample capacity.

Equalizer connections between shell and level controller must be as short as possible. They should insure having the same pressure in the controller body and shell. No obstructions or baffles in heater shell should hamper flow of steam and water into controller. Connections should never be made where high velocities in the heater would cause false levels in the controller body.

Chemical cleaning. Improper feedwater treatment or oxides formed by corrosion can foul heater surfaces. When feedwater outlet temperature drops as much as 10 F the heater should be cleaned.

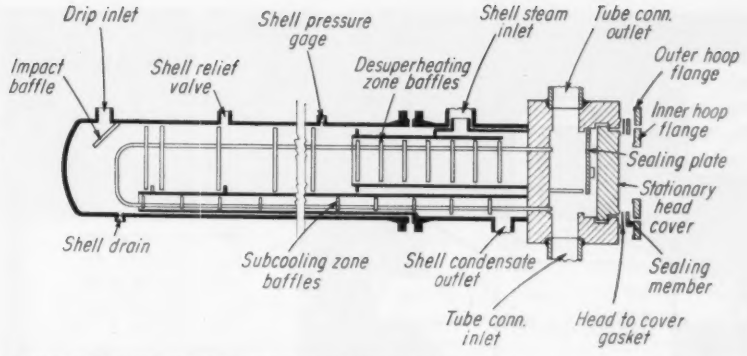
U-tube heaters are cleaned by circulating a carefully controlled chemical solution through the heater that dissolves the scale and solids without attacking the metal. To do this properly the scale must first be analyzed. Chemical cleaning firms offer a complete service.

Mechanical cleaning devices should never be used on U-tube heaters. The small tube diameter and the large number of tubes make this an expensive method. Scrapers and revolving tube cleaners can easily damage the thin wall tubes at the bends.

Tube leakage shows itself by overloading the shell drainage-control valve. The heater should be taken out of service promptly to avoid serious erosion of the tubes next to the leak.

Running a shell air test will locate the leaking tube at the stationary head in a U-tube heater. The leaking tube may be rerolled, plugged or replaced.

A slight leak in the tube joint that



CONDENSING-DESUPERHEATING-LONG-SUBCOOLING heater also works for maximum cycle efficiency; it may be used in horizontal position or vertically with feedwater head up

has not damaged the tube sheet may be repaired by rerolling the joint. The tubes must not be over rolled because this thins the tube ends and hardens them.

High-pressure feedwater jetting through a tube leak impinges on neighboring tubes and makes them vibrate at high frequency. This wears these tubes severely at the support plates. The jet may also severely damage and weaken surrounding tubes. All these tubes, not only the failed one, will have to be located and replaced. Often as many as 12 tubes may need to be replaced in heater because of a failure of just one tube.

In many heaters any U-tube in the bundle can be removed as needed. In 4-pass arrangements there might be interference to withdrawing some of the inner tubes because of overlapping return bends at the floating end of the bundle.

To remove inner U-tubes from a bundle the last two or three support plates are moved far enough forward so the tube bends can be spread apart. This makes room to remove and insert tubes where needed.

Tube joint leaks in a h-p heater usually cut out part of the steel tube sheet—sometimes the entire bridge between two or more tubes may disappear. Damage will depend on the length of time the leak has acted.

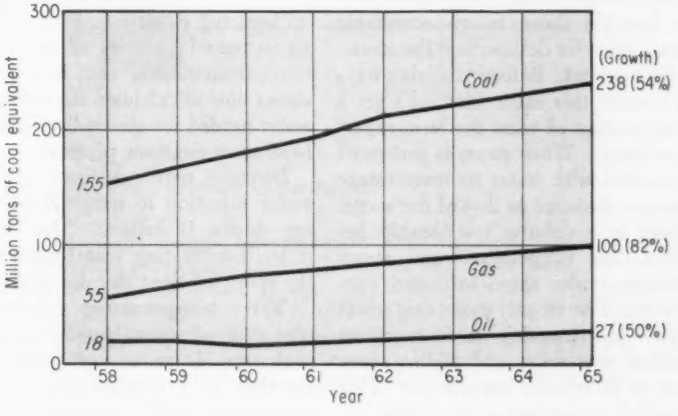
Tubes cannot be replaced when the bridge wall has been destroyed. The tube holes would be welded up in affected area. Tube material would be drilled away for a depth of about 2 in. A steel plug is made, about 1½ in. long, and machined for a drive fit in the tube hole. It is driven in the hole to leave about ⅜ in. of the plug below the tube sheet. Each of the affected tubes would be plugged and the bridge walls cut away between the tubes to a depth of ⅜ in. A weld laid from the top of the steel plugs to the surface of the tube sheet can then be used to protect the heater from further leakage in that area.

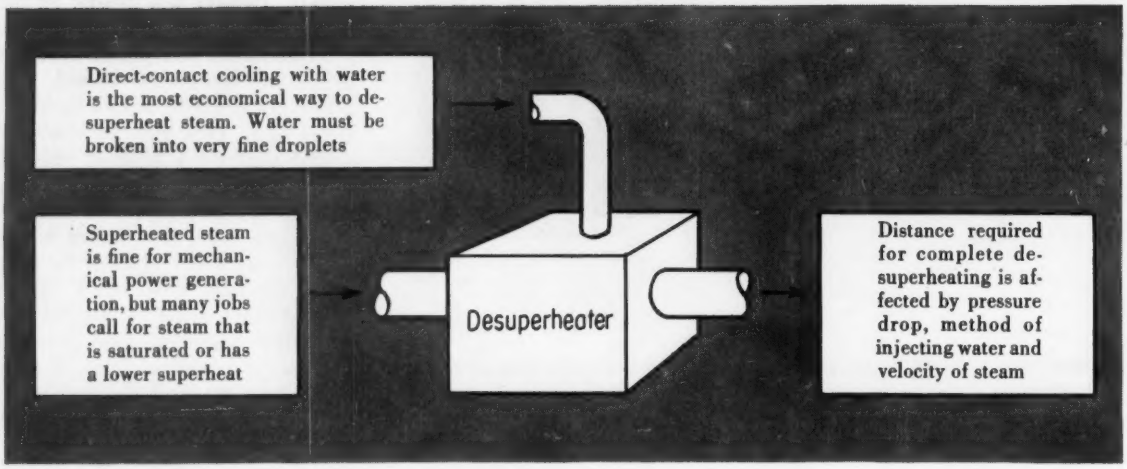
Tube joints never leak in l-p heaters. Leaking tubes can be stopped by driving in brass plugs. Tubes can be replaced later.

Tubes can be removed from tube sheets without damaging the tube hole. Reaming thins down the tube wall to an equivalent 20 gage. A collapsing tool removes the thinned-down portion of the tube end to completely loosen it and remove all the metal from the two grooves in the hole. Many h-p heaters have been retubed without removing the units from their foundation. This sort of work must be done by a trained mechanic familiar with the extreme care that must be used.

Utility survey forecasts 60% rise in fuel use by 1965

Latest survey by *Keystone Coal Buyers Manual* shows that the U.S. electric utilities expect a rising annual fuel consumption through the year 1965. An increase of 60% over 1958 is projected by these fuel users. Largest percentage increase will be enjoyed by natural gas, a total of 82%. Coal will have a 54% increase while oil use will grow 50%. Of the total fuel burned in 1958 coal was 68%, but in 1965 coal will lose ground and be only 65% of total. Sizable fuel switches will be made between the three types in this period.




Direct-contact cooling with water is the most economical way to desuperheat steam. Water must be broken into very fine droplets
Superheated steam is fine for mechanical power generation, but many jobs call for steam that is saturated or has a lower superheat
Desuperheater
Distance required for complete desuperheating is affected by pressure drop, method of injecting water and velocity of steam

Basic job of desuperheater is to speed heat transfer and produce desired steam temperature within the shortest possible distance. Here's data to help you evaluate the many direct-contact methods of . . .

Desuperheating steam with water

By S S BOWLUS, Chief Design Engineer, Copes-Vulcan Div, Blaw-Knox Co

Superheated steam is an excellent source of energy for mechanical power generation. But in certain cases either saturated steam or steam with a lower superheat fills the need best. Then, if steam is delivered in a superheated state, temperature must be brought down to an acceptable level. Thus we desuperheat the steam.

Superheat. Before exploring ways to remove this extra heat, let's get a clear picture of what the term *superheat* means. When steam is generated in contact with water its temperature remains the same as that of the water. There is a definite relationship between this temperature and steam pressure under these saturated conditions. We can only make this steam hotter by removing it from direct contact with water and adding more heat as in a boiler superheater. This is called *superheating the steam.*

When superheated steam is available at a temperature that's too high, it must be partially or completely desuperheated, regardless of how the extra heat was supplied originally. Most common and economical way is the direct-contact method of cooling by water injection. Water placed in contact with superheated steam picks up heat and vaporizes. We then have an increased quantity of steam at a lower temperature. Box, facing page, shows how to calculate the amount of water needed for steady-flow desuperheating at constant pressure.

Distance required from point of water injection to temperature sensing device is critical. The shorter it is, if indicating true temperature, the more efficient the desuperheater.

True temperature reflects the true state of steam leaving the desuperheater. If steam and water exist together in a pipeline and are not completely mixed, a temperature bulb will not give the true reading. Let's take a point of water injection into a steam line. Downstream from this point install a number of thermometers at an arbitrary distance apart. Under most conditions thermometers nearest desuperheater will not read the same. Distance from desuperheater, beyond which successive readings agree (excluding heat lost through insulation), is the closest point at which a valid temperature measurement can be made.

Job of desuperheater is to speed up heat transfer between steam and water so true temperature conditions occur within shortest distance downstream. If water can be broken into very fine droplets, surface area exposed to steam is great, and so evaporation is aided. If particle sizes of water are infinitely small, true temperature distance will be infinitely short. We cannot, of course, break water into infinitely small particles. The term *atomization,* commonly used in desuperheater parlance, is actually

a misnomer in this strict sense of the word. What is really meant is breaking water into small particle sizes.

There are a number of ways to produce small droplet sizes. These include variable and fixed orifice nozzles and other steam-atomizing and steam-assisted types. Each will be discussed in detail later. Another important way to achieve efficient desuperheating is to subject both steam and water to a pressure drop. Velocity change and resulting turbulence is extremely effective. Required downstream distance for a valid temperature measurement is greatly reduced. If a pressure drop can be tolerated, method of injecting the water (droplet size) becomes less critical.

Distance for complete desuperheating is also affected by steam velocity. Even very low flows are turbulent when critical Reynolds' number is exceeded. Reynolds' number is a factor used to determine whether flow will be turbulent or viscous. It's based on mean velocity, pipe diameter, specific gravity of fluid and absolute viscosity. Higher the velocity, shorter the distance needed for mixing. This is true even though it appears that contact time of water with steam is reduced. As flow becomes increasingly turbulent, random movement of entrained water increases. So actual path of an individual particle of entrained moisture will be longer.

Coefficients of heat transfer also increase with higher velocities. Net effect is to shorten the distance for mixing. If velocity is carried high enough, it may be possible to reach a point where still higher velocity is detrimental. Certainly this point, if it exists, is well above velocities used in good piping design. Theoretically, it's possible to attain sonic velocities (speed of sound—Mach 1) before having trouble.

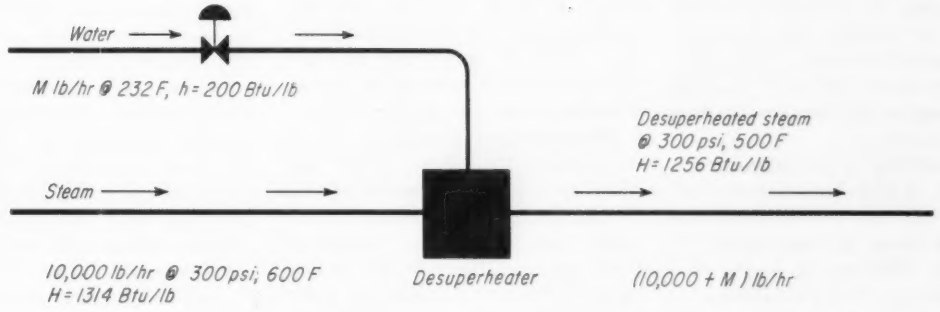
Another important factor is desired steam temperature. Closer this is to saturation temperature, slower the evaporation of water. In general, we can control it to within 10 F of saturation temperature.

Now let's examine test data for an actual application served by a carburetor (mechanical) type desuperheater with built-in steam trap. Steam flow is 300,000 lb per hr at 550 psi and 850 F. Final steam temperature wanted is 525 F (45 F of superheat). Cooling water for this amounts to 50,000 lb per hr. Steam flow varies from zero to 300,000 lb per hr and back to zero in 22 seconds. Final temperature must be controlled within 25 F above or below desired 525 F.

Extremely rapid load swings call for a 2-element control. Control valve position is adjusted by resultant of steam flow and output from a temperature responsive element. Temperature can be measured at five different points.

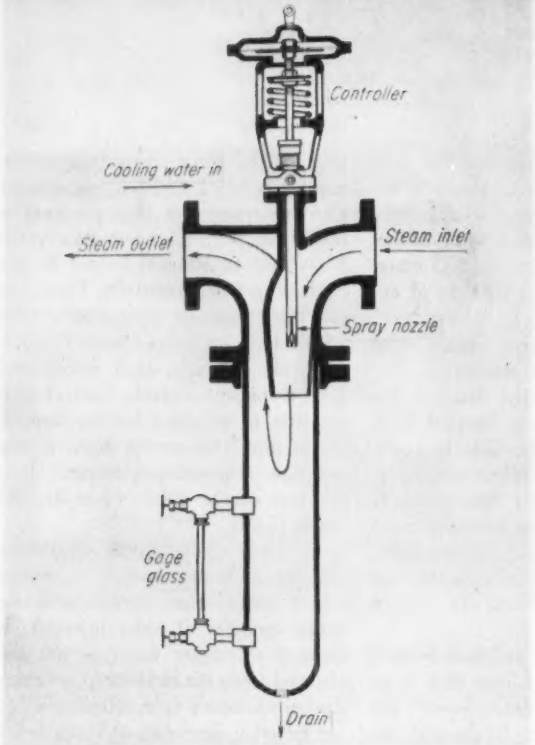
At loads above 30%, theoretical amount of water needed to reduce steam temperature agrees with the actual quantity of water injected. In these flow ranges water is not discharged from the steam trap, so atomization efficiency is excellent.

Efficiency decreases at loads below 30%. Theoretical amount of water needed to reach final temperature is exceeded. Under extreme conditions more water may discharge from the trap than is absorbed in the steam. At very light loads, large increase in water rate is needed for significant

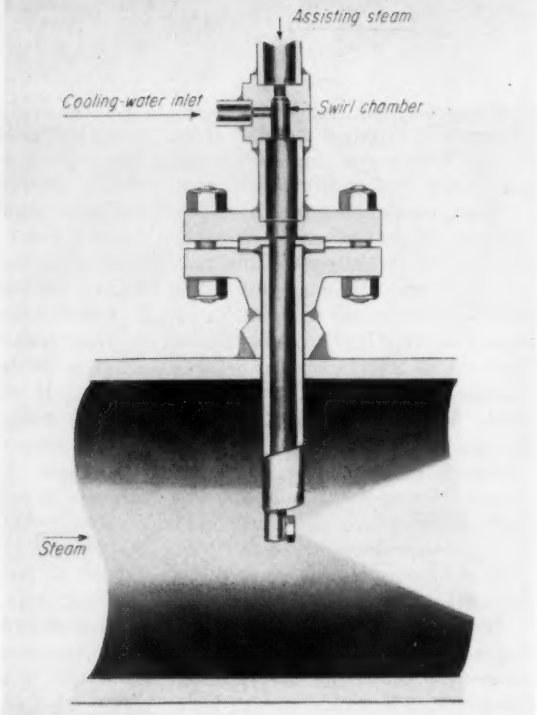


How much injection water is needed?

Diagram, above, gives heat content of steam and water. Suppose we want to lower superheat of steam from 600 to 500 F at a constant pressure of 300 psi. Disregarding radiation losses, total heat entering superheater equals total heat leaving. Thus, 10,000 lb per hr × 1313.6 Btu per lb + M lb per hr × 200 Btu per lb = 10,000 + M lb per hr × 1255.8 Btu per lb. Difference between original and final heat value of steam equals 1313.6 – 1255.8, or 57.8. Difference between final heat of steam and heat in entering water equals 1255.8 – 200, or 1055.8. Then 10,000 × 57.8 ÷ 1055.8 = 547 lb per hr of cooling or injection water. Amount of steam leaving superheater at new temperature then equals the sum of 10,000 and 547, or 10,547 lb per hr.



CARBURETOR type desuperheaters are used on fairly steady loads. Efficiency depends on ability to break water into fine particles



STEAM-ASSIST TYPE mixes steam and water in swirl chamber to inhibit formation of large steam bubbles that cause water hammer

DESUPERHEATING continued

changes in final steam temperature.

Five points of measurement show how steam temperature increases progressively downstream from desuperheater. Measuring elements closest to desuperheater contact extremely small particles of moisture that have not been completely vaporized and superheated by steam. So these readings are low and do not measure the true state of the steam.

Desuperheater performance is evaluated on final steam temperature. And the last two thermocouples are consistent except at loads below 5% where the difference in temperature amounts to only 5 or 6 F. Remember when evaluating desuperheaters that the reading of one temperature bulb or indicating controller is not conclusive even though performance apparently is excellent.

Carburetor (mechanical) type desuperheaters have good spray characteristics and are used where the load is relatively steady.

Steam-atomizing types were developed to obtain a more uniform spray under varying load conditions. A number of present-day designs operate on essentially the same basic principles. Steam and water are brought separately into the steam line. At point of injection water is broken by impingement of high-velocity steam. Problems with this type are similar to those of the carburetor design. And any water that isn't instantly entrained ends up in bottom of the steam line.

Steam-assist types eliminate nozzle troubles by mixing steam and water upstream from the spray nozzle. At first thought this arrangement might seem impractical because of water hammer. However, this is prevented by bringing steam and water together under proper conditions.

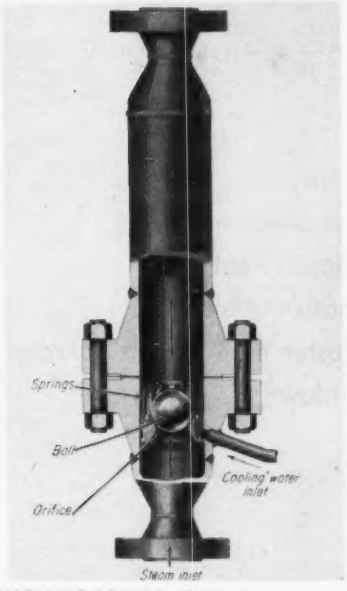
Swirl chamber in design, above, maintains a high velocity between water and steam at the point where they merge. This action inhibits formation of large steam bubbles. Collapsing of these bubbles is the source of most noise when steam and water are mixed. Velocity in the spray barrel between the swirl chamber and nozzle tip is also high.

Both steam and water enter the chamber through a restriction; steam enters tangentially. At zero water flow, steam flow is at the maximum. As water flow increases, less and less atomizing steam is used. But as steam flow and velocity decrease, water velocity through restriction at the top increases continually, maintaining high relative velocity.

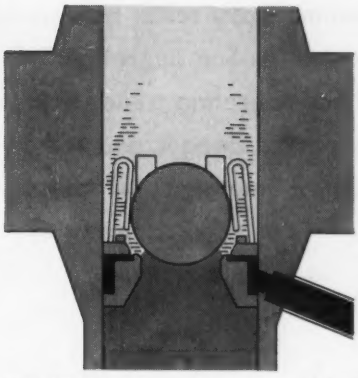
As water flow increases, pressure in swirl chamber may exceed that of atomizing steam. At this point steam flow is zero and a check valve prevents reverse flow of cooling water through atomizing steam line. System is then entirely mechanical. Load point at which this takes place is a function of nozzle selection. Depending on nozzle size, atomizing steam may always remain on, or automatically shut off at, say, 70% load.

Minimum pressure drop across nozzle tip always equals difference between main steam pressure and atomizing steam pressure (less any steam pressure drop through swirl chamber). Tests on this design, using air instead of steam, indicate that the spray is most efficient under very low flow conditions. Since maximum steam flow is a function of nozzle ori-

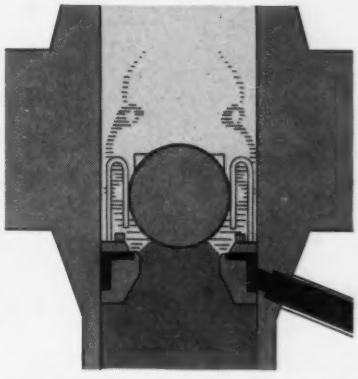
Variable-orifice unit handles wide range of flows



VARIABLE-ORIFICE TYPE has pressure drop in range of 3 to 4 psi for all flows



WEIGHTED BALL on the orifice is raised by force of steam flowing through the unit



FULL LOAD opens orifice completely with pressure drop still in range of 3 to 4 psi

fice size, maximum atomizing steam consumption is very low. In effect advantages of steam and mechanical atomizing types are combined.

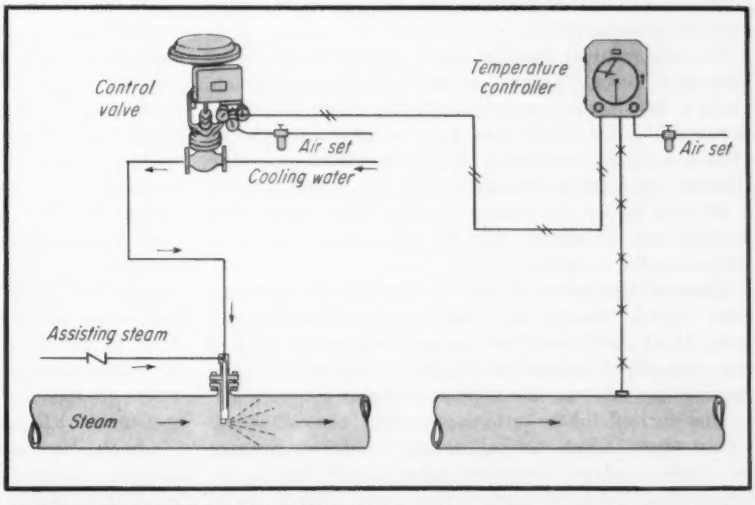
Variable-orifice unit, above, consists of a section of steel pipe enclosing a self-regulating orifice. This orifice is made up of a circular seat with a weighted ball held in concentric position by Inconel springs. These are protected from excessive stress by mechanical stops. Cooling water enters the orifice chamber and is uniformly distributed around the periphery. Amount is controlled by a diaphragm-operated valve actuated by a temperature controller.

Force of steam through the desuperheater raises the ball; each flow rate gives it a different position. Pressure drop is practically constant at 3 to 4 psi for all flows.

Cooling water enters at the seat of orifice where pressure drop is highest. With the ball held in concentric position by springs, incoming steam flows uniformly around the 360-degree periphery where cooling water enters. Pressure drop of steam passing through annular restriction between ball and ring creates an aspirating effect that also helps draw in cooling water. Result is high turbulence over the full range of flow. Cooling water and steam are instantly brought together in an intimate mixture for complete vaporization. Since the unit is always mounted vertically, any water which is not immediately absorbed remains in suspension until it has been completely dissipated.

Variable-orifice desuperheaters hold final temperature within ± 5 F. Temperature controller should be a standard type, below, having both proportional and reset features. Final temperature may be as low as 10 F above saturation. Tests over a 50:1 load range have held reduced steam temperature constant only 20-ft downstream from the outlet.

Each desuperheater type has a definite field of theoretical application. Fully consider all the variables before making your final selection.



TEMPERATURE IMPULSE SIGNALS from the controller, above, actuate the control valve which, in turn, regulates the cooling water that flows to the steam-assist desuperheater

In first fully automatic plant, computer control will . . .

- Handle complete hot or cold startup
- Automatically select best startup procedure
- Control on-line operation for minimum heat rate
- Check operating trends to anticipate trouble
- Recognize danger and trip unit faster than human operator
- Control emergency or normal shutdown

It all adds up to . . .

Control breakthrough at Little Gypsy

A new 225,000-kw plant to be finished in 1960 at Little Gypsy, La., for Louisiana Power & Light Company, will be the first fully-automated electrical-power-generating station. All phases of Little Gypsy's operation—from startup through operation to shutdown—will be controlled automatically by a special electronic computer system designed and built by Daystrom Systems, a division of Daystrom, Incorporated. The electronic control system, which will make possible full automation, incorporates a transistorized general-purpose digital computer. It will be installed at the new Little Gypsy Station which promises to be one of the most modern power-generating facilities in the world.

The new control benefits from experience gained at Louisiana Power & Light Company's Sterlington Station, where a data-logging system containing some 4000 transistors and 7000 diodes has been in successful service without a single component failure for almost one year. (POWER reported on Sterlington in Aug 1958, p 104.)

At Little Gypsy the control loop has been closed. The all-important additional function of control has been assigned to the computer.

Control operation is best understood by following Little Gypsy through a complete startup-to-shutdown cycle. If we could enter the control room, we would find neat rows of pull-out cabinets housing computer elements, data-logging printers, a compact computer console; and a miniaturized boiler-turbine-generator control panel.

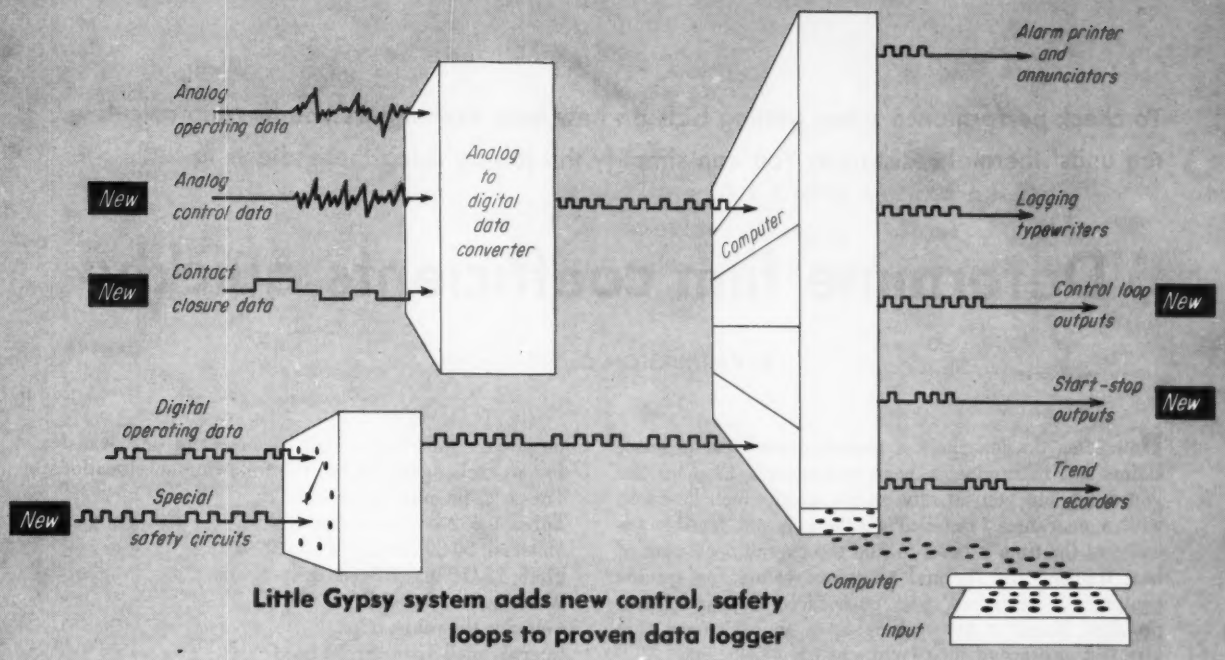
Unit operator gets the ball rolling by simply pushing the startup button. Computer automatically begins the complicated, 4½-hour startup procedure. This is about 1½ hours faster than conventional manual control.

Startup for this large generating unit must be conditionally and sequentially controlled through approximately 800 steps. There are extensive and detailed decisions involved in preparation of programmed steps. For each of the 800 steps the computer scans—at 10 points per second—700 different temperatures, pressures, flow rates, valve and switch positions. If all is in order, electrical command goes out to hundreds of valves and switches to change to the next position.

As an example of startup control let's follow the computer through Step 144. This step calls for opening four condenser vents and checking other circuits. Control activates a relay which opens the four vents, and signals back to the computer when eight limit switches in series have all closed. Computer waits for limit switches to feed back a signal. If not received within two minutes, alarm system goes into action. Computer will not proceed until feedback from limit switches is received, indicating all previous steps are satisfied.

Operator may decide to instruct the computer to turn back or skip ahead to any other operational step, or the computer may decide to try a different tack. System monitors a large number of selected input signals continuously, and as we watch the startup, computer may reprogram itself to follow an alternate path. Conventional timers, sequential cams and sensing relays could follow computer action to this point, but complicated alternative startup sequences are beyond their capabilities.

On-the-line control follows 4½ hours later as the computer reaches the end of the startup sequence. Without further intervention by the operator, computer puts the station on the line, automatically reprograms itself



Little Gypsy system adds new control, safety loops to proven data logger

and goes into operational mode. It will continue to run the plant operating major control loops for combustion control, steam temperature control, feedwater control and spray control, which overrides steam temperature control as a safety feature. Computer does not maintain major control directly, but acts as set-point adjustment for conventional tried-and-true control loops.

Computer will be in continual contact via microwave link with the main LP&L dispatching station in Pine Bluff, Ark., which will tell the computer directly to increase or decrease station output. Within one second of a command, proper action can be taken simultaneously on all operating loops.

Safety circuits connected to the computer will monitor hundreds of individual items, including generator phase and flame failure. Fuel safety and purge system will constantly check for an explosive mixture in the boiler. If one occurs, fuel shuts off instantaneously and boiler is purged with air for a fixed period of time.

Simultaneously with fuel trip, necessary shutdown procedures would go into effect. The operator could show us the continual scanning action of all inputs for over- or under-limit operation. If any occur and cannot be corrected by the system, visual, audible alarms and special printout will tell operators exactly which point is off, and how far it is out of bounds.

Operator points out the flexibility this gives him. As long as everything is going smoothly, no human intervention is required. If the computer finds it has become confused or cannot correct an operating problem, it resigns control. If the operator wishes to take over, he would bypass the computer and operate from the control console. In either case bypassing the computer leaves standard semiautomatic controls in command and merely removes the added safety and optimizing features.

Data-logging features of the computer will follow design used at Sterlington Station. If we moved over to the logging printers, we would have important operating data supplied to us by one typewriter and statistical records by another. In addition, trend recorders would give us a continual record of heat rate.

Operator may select any frequency of data logging he desires, from hourly records to operating guides every two minutes. Alarm printer will follow Sterlington scheme of supplying immediate identification of an off-limit reading and high-speed handy logging of the measured value. In this manner the operator receives all information needed for emergency action immediately and without moving from the control console.

Shutdown of a large unit is almost as complicated as startup, but computer control handles complexities of complete or temporary shutdown and banking boilers without a quaver. As we watch, the operator pushes the shutdown button and calls for standby arrangements for hot start. Computer automatically begins a controlled shutdown which may take another four hours to complete, and will leave unit prepared for fast load pickup.

Our short visit probably would convince any power engineer of Little Gypsy's safer and more efficient operation, but he would undoubtedly ask about cost. Little Gypsy's fully automatic control will boost station cost about 2.5% over conventional centralized control units. Louisiana Power and Light considers this money well spent for operating safety and optimized performance.

To check performance when getting bids on new heat exchangers you have to calculate the units' thermal resistance. You can simplify this job by using these charts to . . .

Determine film coefficients quickly

By R S THURSTON, Cornell University

How often do you check a manufacturer's performance claims before buying a heat exchanger? Chances are you don't, but you do rely on his word which he backs with a guarantee. Detailed checking is not feasible because of the time it takes to find the overall coefficient of heat transfer and thermal resistance values for specific equipment. Designers, who once faced this same time problem, licked it by working up a set of curves that give fast answers to such factors as film coefficients.

Charts on the next page boil down the handbook searching and log-table thumbing into curve form so you can find U values quickly and with small chance of mistake. Tear them out and keep them handy so you'll have them when checking time crops up.

Main advantage of the charts lies in finding the tube's inside and outside film coefficients, h_i and h_o (from the thermal resistance formula $R_t = l/k + 1/h_i + 1/h_o + R_f$). Thermal conductivity, k, and recommended values for the fouling factor, R_f, can be found in the Standards of the Tubular Exchanger Manufacturers Association. Since the middle two quantities of the formula are the tedious part, the charts let you find all parts of R_t quickly.

First two charts (Fig. 1 and 2) give you h_i and h_o direct, but only for a specific exchanger design. Fig. 1 contains the correction chart for h_i; Fig. 3 to 5 give the factors needed to adjust the h_o values of Fig. 2 to the exchanger you're working on.

Fig. 1 is based on:

$$h_i = 0.027 \frac{k^{0.6} c^{0.4} w^{0.8}}{U^{0.4}} \times \frac{U^{0.8}}{d^{0.2}}$$

using ⅜-in. 18-Bwg tubes. The small correction curve (insert) supplies adjustment for tubes that aren't 0.277-in. ID (0.375 – 0.098). This is only correction needed to get correct h_i.

You'll find tube's outside film coefficient from Fig. 2, based on (a) $h_o = 0.36\ (k/E)\ (Eg/u)^{0.55}\ (cu/k)^{0.33}$ and (b) a heat exchanger with design values of ¾-in. 18 Bwg tubes, 40-in. inside shell diameter, 16-in. baffle spacing, 1-in. pitch with triangular spacing, and a 0.212-in. hydraulic equivalent. To get the h_o of other exchangers apply the correction factors from Fig. 3 to 5. (See box facing page for symbol definition.)

Some terms in the formula for h_o reduce to $G = W/a$, $a = D\ (p - d_o)\ b/p$ and $E = p^2 - 0.785 d_o^2$ for rectangular spacing and $0.433p^2 - 0.397d_o^2$ for triangular spacing of tubes. Hypothetical cross section for flow through the tubes equals a and E is the hydraulic equivalent for the tube arrange. ent.

Correction factors. Let's use an example to show how to find correction factors and what to do with them. Suppose you want the overall coefficient of heat transfer U for an exchanger that has the following specifications:

Tubes, ¾-in. outside diameter, d_o
Tubes, 0.652-in. inside diameter, d
Material, 70-30 cu-ni ($l/k = 0.00049$)
Pitch, 15/16 in. with triangular spacing, p
Water, tube side, 60 F
Velocity, tube side, 6 fps, v
Internal shell diameter, 24 in., D
Baffle spacing, 22 in., b
Water, shell side, 100 F
Mass flow, shell side, 400,000 lb per hr, W

Start by eliminating the first and last terms of the thermal resistance formula. In this case, l/k is 0.00049 and the fouling factor, R_f, is assumed to be 0.001.

Next find the inside film coefficient. Fig. 1 shows a value of 1160 Btu per hr per ft² per deg F when tube-side velocity is 6 fps and temperature is 60 F. But this value holds only for ⅜-in. 18-Bwg tubes. Since tubes in the example are ¾-in. OD and 0.652 in. ID, chart coefficient must be corrected; correction factor from the small insert in Fig. 1 is 0.967 for a tube ID of 0.652 in. Multiplying the coefficient and correction factor gives an actual h_i of 1120 Btu per hr per ft² per deg F.

Now find h_o. Fig. 2 indicates an uncorrected outside film coefficient of 635 Btu per hr per ft² per deg F for a mass flow of 400,000 lb per hr. Although the tube size in the example is the same as that used to design the curves, the balance of design and example values differ, so again you have to apply the correction factors.

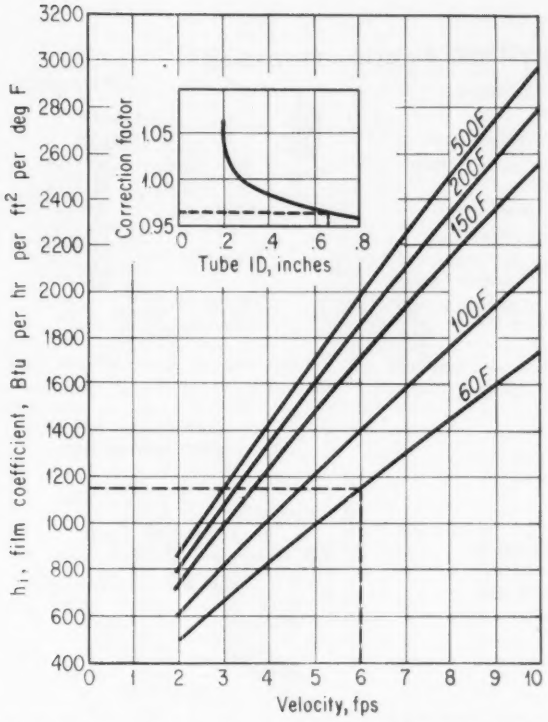
Flow rate in the example is less than a million lb per hr so we don't need Fig. 5. But if flow does exceed a million lb per hr for any exchanger, Fig. 5 gives the right correction factor directly. Secondary formulas help find the first two correction factors—for cross section and hydraulic equivalent.

Here the formulas for a and E come into play. In the example, substituting values to get a yields $2(0.938 - 0.750)\ (22)/(0.938)\ (12)$ or 0.735 sq ft. This is the abscissa for Fig. 3; correction factor is 1.27. Next calculate E for triangular spacing: $0.433\ (0.938)^2 - 0.397\ (0.750)^2$ or 0.158 in. This is the abscissa value for Fig. 4 and produces a hydraulic equivalent correction of 1.14.

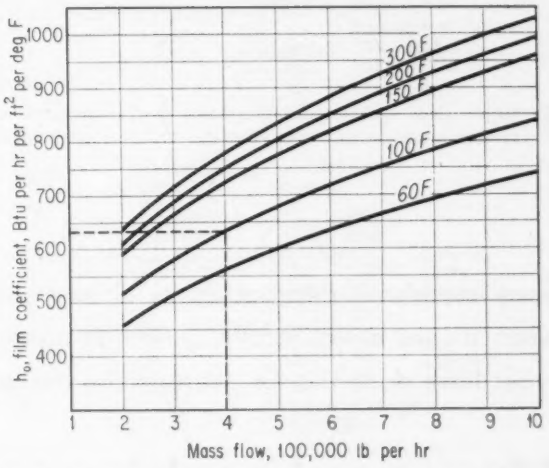
At this point we have all values—uncorrected h_o (635) plus correction values for a (1.27) and E (1.14)—to get h_o for the example. When multiplied they give an outside film coefficient of 918 Btu per hr per ft² per deg F.

Final step substitutes the four known parts into the thermal resistance formula to find $R_t = 0.00348$. Reciprocal $U = 287$ Btu per hr per ft² per deg F.

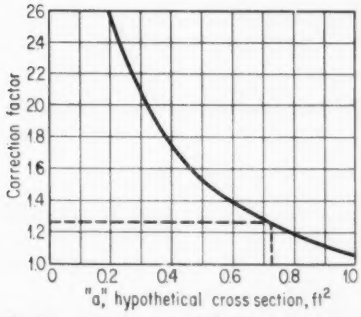
Fig. 1 and 2 give h_i and h_o for specific designs. Adjust these values by the correction factors



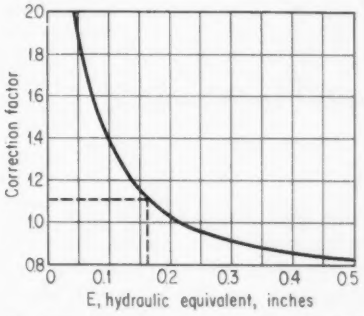
1 Inside film coefficients, h_i, are for ⅝-inch 18-Bwg tubes (0.277-inch ID). For tubes of different ID's multiply chart values by the correction factor (inset) to get the actual h_i



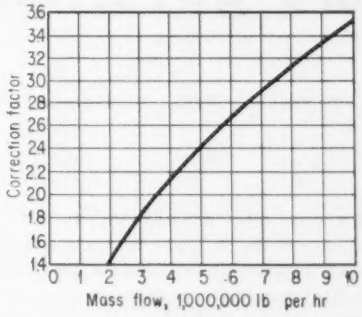
2 Outside film coefficients, above, come from one exchanger design. Since most exchangers have different design values, this chart is only the first step in finding the corrected h_o



3 Second step toward h_o is hypothetical area correction. Values on either side of unity correction equal $(1.11)/a)^{0.55}$



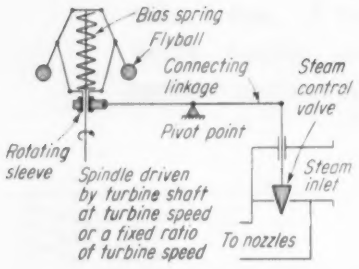
4 Step three is correction for hydraulic equivalent, E. To get curve values multiply solutions to E by $(0.212/E)^{0.45}$



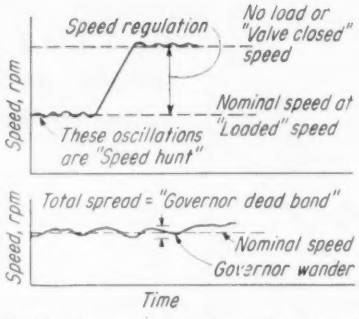
5 If flow exceeds 1,000,000 lb per hr factors above are fourth step. Otherwise, first three steps give you answer to h_o

Symbol definitions and units

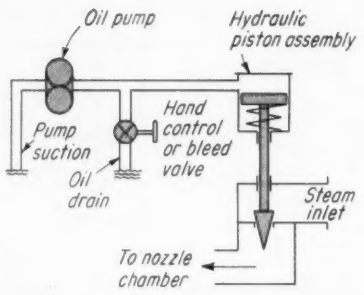
R_t = Total thermal resistance, (Btu per hr per ft² per deg F)$^{-1}$
U = Overall thermal conductivity, Btu per hr per ft² per deg F
l = Depth of wall between heat-transmitting media, ft
k = Thermal conductivity, Btu per hr per ft² per deg F per ft
c = Specific heat, Btu per lb per deg F
w = Specific weight, lb per ft³
u = Viscosity, lb per ft per hr
h_i, h_o = Film coefficients, internal and external to the tube wall, Btu per hr per ft² per deg F
R_f = Fouling factor, (Btu per hr per ft² per deg F)$^{-1}$
v = Velocity, lb per ft per hr
d = Internal diameter of tubes, F
W = Mass flow rate, lb per hr
D = Shell internal diameter, ft
p = Pitch of tubes, ft
d_o = External diameter of tubes, ft
b = Length between baffles, ft



1 Simple shaft governor positions the turbine steam-control valve directly



2 Turbine-speed variation with load and time can be described by special terms

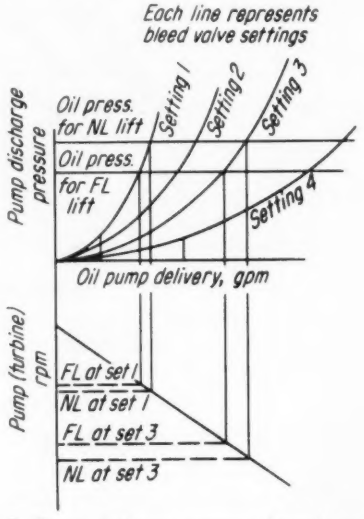


3 Direct-acting oil governor uses pressure of pump to control steam valve

Since machinery approaches its ultimate usefulness when it runs automatically, power producers of all types have done this for years. Here you learn . . .

How m-d turbines are governed

By Engineering Section, Small Steam Turbine Dept, General Electric Co



4 Pump discharge pressure depends on shaft speed and bleed valve settings

In controlling a steam turbine we use the shaft speed to signal the balance between steam energy input and shaft energy output. Excess input raises the speed, deficient input drops the speed, while a constant speed shows input equals the output.

Speed governors produce the signal used to control the turbine and process of which it may be a part. NEMA Standard SM-20-1958 and American Petroleum Institute Standard 615 define speed governing terms and characteristics desired. Each turbine builder develops components to meet these specifications.

One form of simple governor, Fig. 1, has flyballs or weights driven by the turbine shaft. These weights develop a centrifugal force that opens and closes the steam inlet valve of the turbine. A bias spring limits the weight movement through a given range.

During starts, the spring holds the weights in their *at rest* position until the centrifugal force overcomes the spring force and allows the linkage to move the control valve from its *wide open* position towards a partly closed one. At some point the rising speed positions the weights and control valve so energy input matches shaft energy output to hold speed constant, and the unit *governs*.

If the shaft energy demand should drop, the speed would rise. This moves the governor weights outward against the bias-spring force and the connecting linkages decrease the control valve opening. Energy input will then match the lower output at a higher speed.

The change in speed with change in load and steam flow is the *speed regulation*, Fig. 2. In a governor the combination of weight, spring characteristic, level proportion and valve flow characteristic dictate the speed change needed to match a given steam flow change.

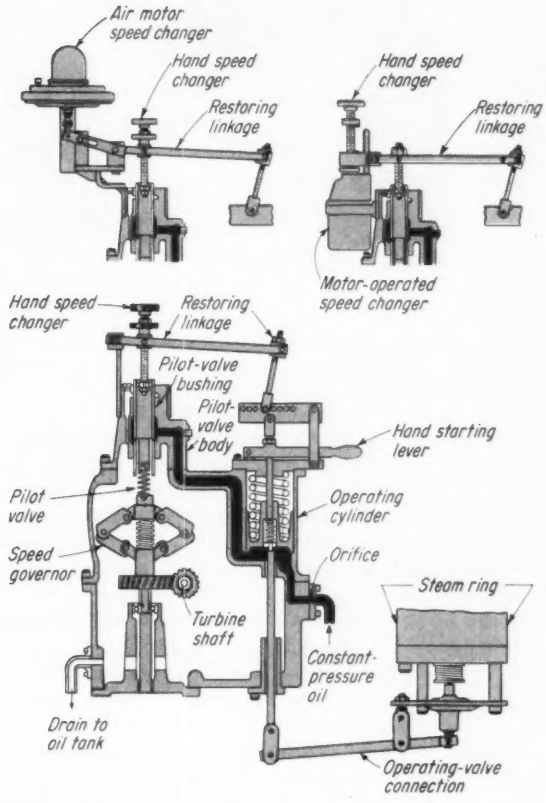
Speed regulation can be changed by altering any of the governor components. If they are changed so speed vs valve flow becomes progressively narrower, the governor's ability to hold a specific position for a given speed diminishes. This reduces the governor's *stability* and it *hunts* or has *speed variation*.

Friction or lost motion in the linkages increase the speed change needed to move the control valve. This makes the turbine wander from a set speed and produces *dead band* or governor insensitivity.

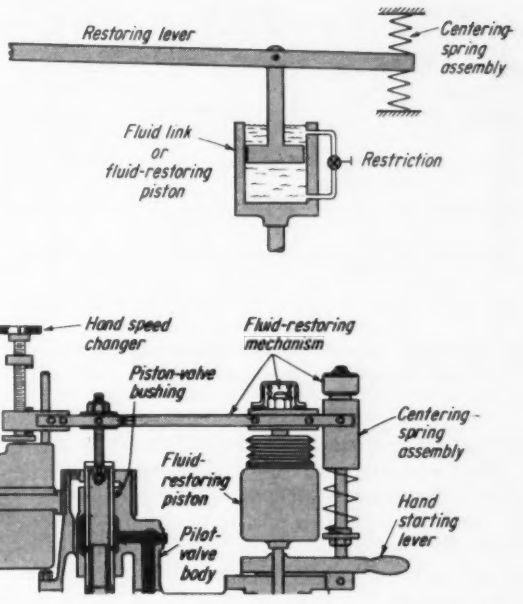
Governors of the type in Fig. 1 have a limiting feature: the speed indicator also supplies power for positioning the control valve. This dictates low steam flows, steam balanced valves and the lowest standard of governing.

Hydraulic governing, Fig. 3, uses a gear type oil

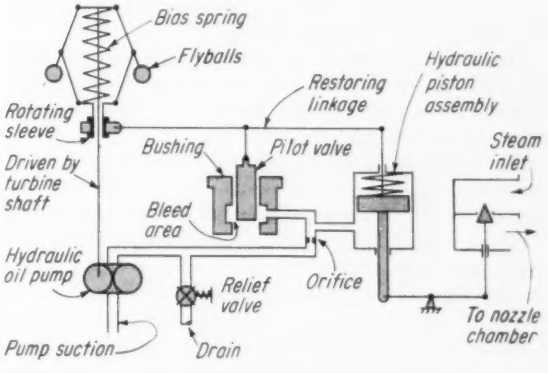
Governors adapt easily to different specifications



5 Oil-relayed speed governor can have its setting changed by hand or remote control through air, hydraulic or electric motor



6 Isochronous governor holds constant speed with aid of dashpot and centering spring assembly, eliminates speed regulation



7 Oil-relayed governor has pilot valve control the oil pressure that positions the steam inlet valve by the hydraulic piston

pump driven by the turbine shaft. The pump's discharge pressure, controlled by bleed valve, positions steam valve by acting on the spring-opposed piston in oil cylinder.

All of the pump discharge must pass through the bleed valve. When the shaft speed rises, the pump pressure rises if valve setting is not altered. Varying valve setting changes relation between speed and oil pressure, Fig. 4.

Hydraulic governors perform well on many applications. They have one serious drawback—oil viscosity changes with temperature and varies the pump delivery-speed curve. Hot, less viscous oil squeezes out of the pump and valve clearances more easily so the pump must run at a higher speed to deliver a given pressure.

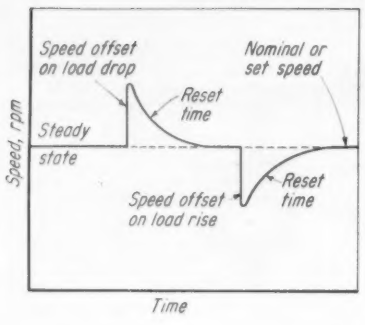
Oil-relayed governors combine the best features of the two systems we just discussed. These use hydraulic pressure to move the control valve and a flyball governor to measure speed, Fig. 7. The governor's weak force moves the hydraulic relay valve to precisely control the pressure developed by the shaft-driven oil pump.

Not all the oil delivered by the pump passes through the pilot valve to the operating cylinder. Bleeding oil from the system through the relief valve maintains reserve power in the system. An orifice meters the oil flow to the governing system and very small movements of pilot valve cause large variations in hydraulic-cylinder oil pressure. Oil flows continuously through pilot valve.

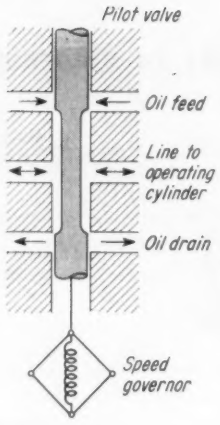
Combination of orifice and oil control valve sizes can be arranged to give any desired oil pressure change for 0.001-in. movement of the bleed valve. Standard practice makes governed oil pressure change about 10% of relief valve setting for 0.001-in. pilot-valve movement.

To prevent violent hunting the pilot valve must also respond to movement of the steam-control valve. This is done by the *restoring linkage.*

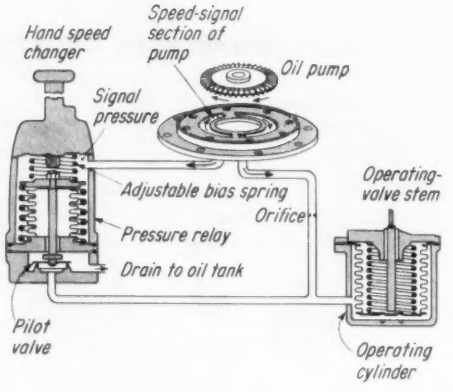
The flyball governor positions the pilot valve and establishes a relative area ratio between orifice feed area and pilot-valve drain area. This ratio controls oil pres-



8 Isochronous governor speed changes as load changes, returns to set speed



9 Multiple-landed pilot valve allows more oil flow to control steam valve



10 Signal pressure acts on bellows to position pilot valve, bleed power oil

sure in the operating cylinder to position the steam valves.

When load drops, the speed rises and outward movement of the governor weights lifts the pilot valve. This increases the drain area relative to the orifice area, and lowers the pressure under the hydraulic piston allowing the spring to push it downward and decrease the steam valve opening. But downward motion of the piston also moves the pilot valve down to reduce the bleed area and prevent too rapid a drop in hydraulic pressure. Thus every move of the control valve opposes the move of the governor and "tones down" the pressure change through the action of the restoring linkage.

Time delay between initial offset by the speed governor and followup in the restoring mechanism is negligible. Under normal load changes there is no relative movement between the pilot valve and its seat.

The restoring linkage forces the speed governor to travel through a longer stroke than if it controlled the pilot valve with no feedback from the steam-control valve. Minimum usable linkage ratio depends on the speed governor signal being stable for a given valve position within specifications of the process being controlled.

The oil pilot valve need only move 0.002 to 0.003 in. to stroke the operating piston over its full travel. Practically, the pilot valve stays fixed and relative movement of governor and hydraulic piston depends on proportions of the restoring-linkage lengths. This achieves the basic concept of speed governors without the governor supplying power to move the control valve. Changing relative lengths of the restoring linkage sets the speed regulation accurately for the governor.

Fig. 5 shows an actual governor arrangement. The speed governor stands directly below the pilot valve and connects to it directly. The bushing attached to the lever system becomes a movable seat. This eliminates connecting a rotating member to a stationary member, and replaces static friction in the valve with dynamic friction. This gives a more accurate speed signal.

Raising or lowering the end of the top lever of the restoring linkage moves the pilot valve and sets the governor to hold speed at another value. This can be done by the hand speed changer or by an air-, hydraulic- or electric-motor-operated speed changer, top Fig. 5.

By using output signals from process controllers to actuate the pneumatic or hydraulic speed changer the turbine can maintain a prescribed process output or adjust turbine speed to match changes in process output and maintain equilibrium.

Isochronous governors maintain a specified speed without regulation regardless of load changes. This is especially important in paper making where the machine speed must be held constant to hold paper uniformity.

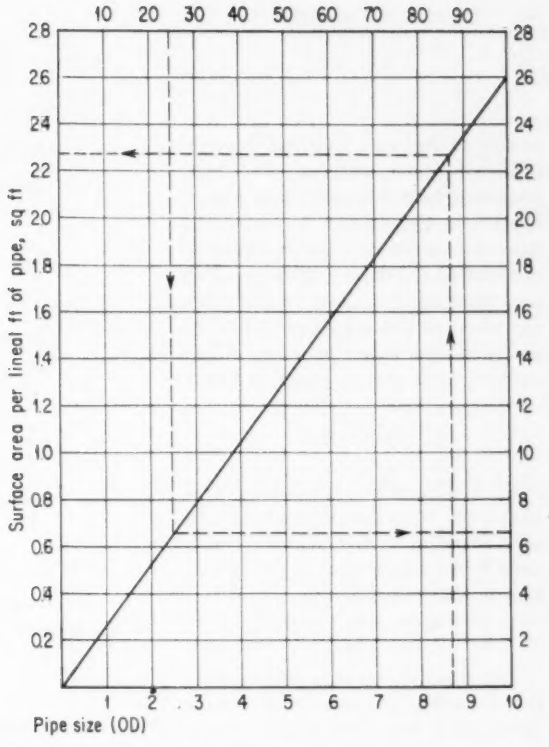
Fig. 6 shows this governor which incorporates a dashpot and spring assembly to return the restoring linkage back to original position. Under transient loads the dashpot acts as a solid link and the speed changes, Fig. 8. As the linkage changes from neutral position the positioning springs load the dashpot. As the fluid flows through the dashpot bypass the springs return the linkage and pilot valve to original position to again hold the steady-state set speed.

Multiple-land pilot valve, Fig. 9, can replace the metering orifice and bleed type pilot valve. The upper land acts as a variable metering orifice and the lower land as a bleed or drain orifice. The combined areas establish the hydraulic governing pressure to position the steam valve.

As the metering area increases, the bleed area decreases and vice versa. This gives a larger oil pressure change for a given pilot-valve offset, useful to develop greater forces. Governed oil pressure change of about 20% of relief-valve oil-pressure setting for every 0.001 in. movement of pilot valve is standard practice. This positions control valves faster during large load changes.

Force balancing replaces the flyball governor with a vane or turbo type pump with a speed-vs-signal characteristic not affected by oil temperature. Fig. 10 shows how a speed-signal pressure acts on a bellows in an amplifying relay to position a pilot valve that bleeds hydraulic power oil from behind a metering orifice. This establishes the oil pressure to position the steam valves. Signal pressure and metered power pressure oppose each other across the bleed valve to force a greater pressure change on the signal side to produce a given valve travel. Spring forces hold the system in equilibrium. They can be varied to hold a given speed.

By C R KISE, PE, Baldwin-Hill Co



6 This chart is useful for rapidly approximating areas (sq ft) of various diameter piping. Be sure to use pipe's outside diameter

Last month we dealt with simplified ways to calculate radiation and convection losses from bare plane surfaces. Now let's . . .

Find heat loss through insulation

In addition to last month's Fig. 1 to 5 dealing with radiation and convection losses from plane surfaces, we can employ Fig. 6, above, for rapidly approximating areas of pipes of various diameters. Now let's look at some examples that will show how to use the diagrams we've had so far.

Example 1: An indoor 8-in. pipe (8⅝-in. OD) carries steam at 250 F. Pipe is mostly horizontal and ambient temperature averages 65 F. What would be heat loss if the pipe were not insulated?

From Fig. 1: $h_r = 1.49$
From Fig. 2 and 3:
$h_c = 0.885 \times 1.185 = 1.05$
$h = 2.54$
$q = h\ (t_s - t_a) = 2.54\ (250-65) =$ 470 Btu per hr per sq ft

From Fig. 6: $q' = 470 \times 2.26 =$ 1062 Btu per hr per ft of pipe

If pipe is painted aluminum, h_r is reduced to $1.49 \times \frac{0.50}{0.90} = 0.83$

and q' = about 786 Btu per hr per ft of pipe

Example 2: An outdoor 24-in. OD pipe, internally insulated, carries air at 1200 F. It is desired to limit heat loss to 4000 Btu per hr per ft of pipe under average ambient conditions of 50 F with 20 mph wind. What will the pipe temperature be under those conditions?

From Fig. 6: Pipe area = about 6.3 sq ft per ft
$q = 4000/6.3 \times 0.635$ Btu per hr per sq ft

Since trial and error is involved, try two points: $t_s = 150$ F; $t_s = 200$ F

From Fig. 1: $h_r =$	1.10	1.26
From Fig. 4: $h_c =$	5.10	5.10
$h =$	6.20	6.36
$t_s - t_a =$	100	150
$q = h\ (t_s - t_a) =$	620	955

This indicates that surface temperature must be limited to about 150 F to keep heat loss within desired limits. Note that Fig. 5 is based on a film temperature, or average of surface and air temperatures, of 140 F, and includes a correction curve for lower or higher film temperatures. Correction is small, however, and considering accuracy limits of known data and alignment chart, factor can be ignored unless it is at least 2%.

Heat loss. Let's take a look now

at how to deal with heat loss through insulated plane surfaces. Problems involving heat loss and heat transmission in general can be likened to flow of electricity. Flow is equal to potential divided by resistance. For heat transmission, flow is generally expressed in Btu per hr per sq ft, q, and potential is temperature difference (t_1–t_2 or Δt). In equation form:

$$q = \frac{\Delta t}{R}$$

Up to now we've been dealing with heat losses from exposed surfaces. In such cases, $\Delta t = t_s$–t_a and the resistance R is the reciprocal of the overall heat transfer coefficient h, so:

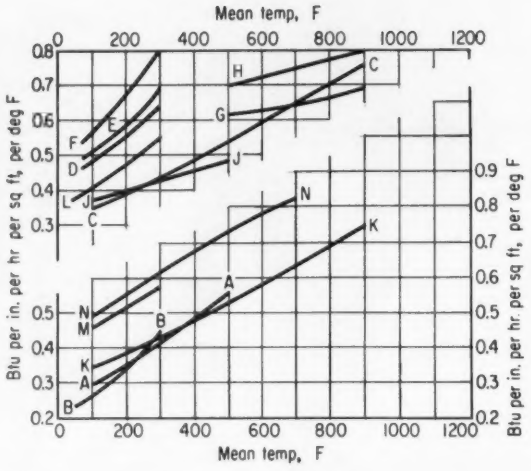
$$q = \frac{\Delta t}{R} = \frac{t_s - t_a}{1/h} = h(t_s - t_a)$$

Fig. 9 illustrates a common situation in which insulation of a certain thickness x has been applied externally to a flat-sided vessel. Inside, surface and ambient temperatures are represented as t_i, t_s and t_a respectively. There are three potentials or differential temperatures to be considered: t_i–t_s; t_s–t_a; t_i–t_a. If we call insulation resistance R_i, the equation for heat flow can be written three ways:

$$q = \frac{t_i - t_s}{R_i} = \frac{t_s - t_a}{1/h} = \frac{t_i - t_a}{R_i + 1/h}$$

This states, among other things, the obvious fact that for a given area heat transfer rate through the insulation equals heat loss from surface to atmosphere. Resistance of insulation depends upon its thickness, x, and its thermal conductivity. Latter is expressed as the familiar coefficient k, whose units are Btu per hr per sq ft per deg F per in. thickness. Resistance of the insulation can be expressed: $R_i = x/k$.

Coefficient k varies, not only with the material's nature but also with its temperature. Thermal conductivity (k factor) data, therefore, are usually given in curve form or at enough points to permit plotting a curve from which the proper value corresponding to mean temperature through the insulation can be selected. Mean temperature is average of inside surface temperatures: $t_m = (t_i + t_s)/2$.



7—k factors for common insulation materials

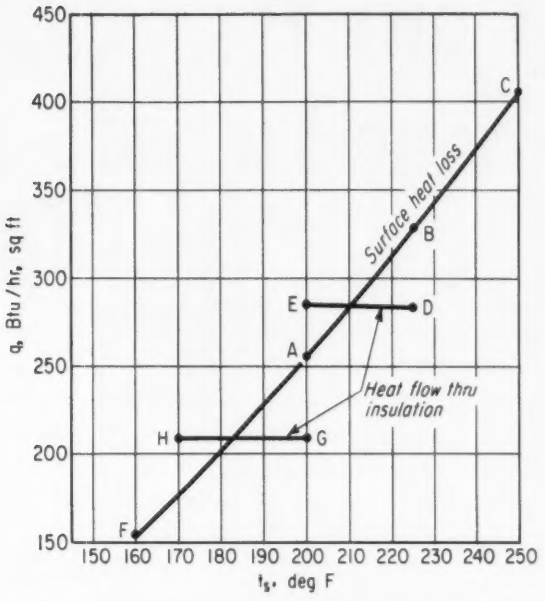
Form	Material	Temp limit	Curve
Blankets	Mineral wool		
	Metal reinforced	1200	A
	Felt type	450	B
Pipe insulation, blocks and boards	Asbestos		
	Molded amosite and binder	1200	C
	Corrugated laminated paper, 4 ply	300	D
	Corrugated laminated paper, 6 ply	300	E
	Corrugated laminated paper, 8 ply	300	F
	Calcium silicate and asbestos	1200	K
	Cellular glass	800	L
	Diatomaceous silica	1500	G
	Diatomaceous silica	1900	H
	85% magnesia with asbestos	600	J
Blocks and boards	Mineral wool, h-t (resin bonded)	600	A
	Mineral wool, h-t (inorganic binder)	1600	K
Cements	85% magnesia with asbestos	600	M
	Mineral wool with colloidal clay binder	1800	N

Fig. 7 shows k factors for some of the more common industrial insulations. Values shown will usually be safe for conservative estimating purposes, but more accurate results can be obtained with manufacturers' data for specific products under consideration. Temperature limits listed in Fig. 7 are commonly used as maximum allowable hot-face temperatures, but are not necessarily correct for specific products.

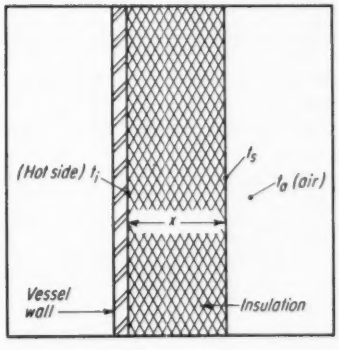
Last month we dealt with heat loss from a surface of known temperature. As we pointed out, however, when insulation is applied the insulation's exterior becomes the surface exposed to air. And the temperature of this surface is unknown. But both this unknown temperature and the heat flow can be found by remembering that heat transmitted through the insulation equals that lost from the surface:

$$q = \frac{t_i - t_s}{R_i} = h\,(t_s - t_a)$$

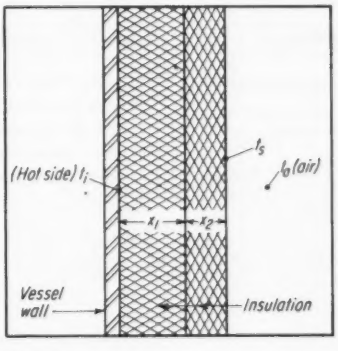
By trial-and-error we can find a surface temperature at which the two sides of the equation will balance. Still better, we can plot t_s vs q for both sides of the equation on the same graph and find the point of intersec-



8 Unknown surface temperature, heat flow is found by fact that heat transmission through insulation equals loss from surface



9 Common insulation method involves using three temperature differentials



10 Compound insulation involves more factors, but basic problem is the same

tion. The recommended procedure, illustrated in Fig. 8, is as follows:

(1) Make a rough guess at the surface temperature and select two other points, say, 25 to 50 degrees above and below this value. For each of the three points find: h (equals $h_r + h_c$) from last month's nomographs, and $q = h\,(t_s - t_a)$.

(2) Plot these points with t_s for the "x" axis and q for the "y" axis, and connect them with a smooth curve.

(3) For the middle value of t_s, find the mean temperature through the insulation and the corresponding k factor. Then $R_1 = x/k$; $q = (t_i - t_s)/R_1$

Now plot this point on your graph.

(4) If this point falls to the left of the surface loss curve, try another point at a higher surface temperature. If it falls to the right of the curve, try another point at a lower temperature. Repeat the procedure in Step 3 and plot point on the graph.

(5) Connect the two points from Steps 3 and 4 with a straight line. This line intersects surface loss curve at correct surface temperature and corresponding heat loss per sq ft.

Now let's try an example. We'll number the steps as we have above. An indoor furnace is to operate at 1200 F with average ambient temperature of 80 F. Find surface temperature and heat loss for vertical walls insulated with 2-in. material having a k factor of 0.40 at 300 F; 0.52 at 600 F; and 0.70 at 900 F.

(1) Surface heat loss:

	A	B	C
Assume: t_s	200	225	250
t_a	80	80	80
$t_s - t_a$	120	145	170
h_r (from Fig. 1)	1.35	1.44	1.54
h_c (from Fig. 2)	0.785	0.82	0.855
h	2.135	2.26	2.395
$q = h(t_s - t_a)$	256	328	407

(2) Plot t_s vs q (Fig. 8, Points A, B and C)

(3) Heat through insulation, middle point:

$t_i = 1200$
$t_s = 225$
$t_i - t_s = 975$
$t_i + t_s = 1425$
$t_m = 1425/2 = 713$

k factor (from a curve of known points) = 0.581 at 713 F
$R_1 = x/k = 2/0.581 = 3.44$
$q = t_i - t_s/R = 975/3.44 = 283$ Btu per sq ft
Plot this point on the graph (Fig. 8, Point D)

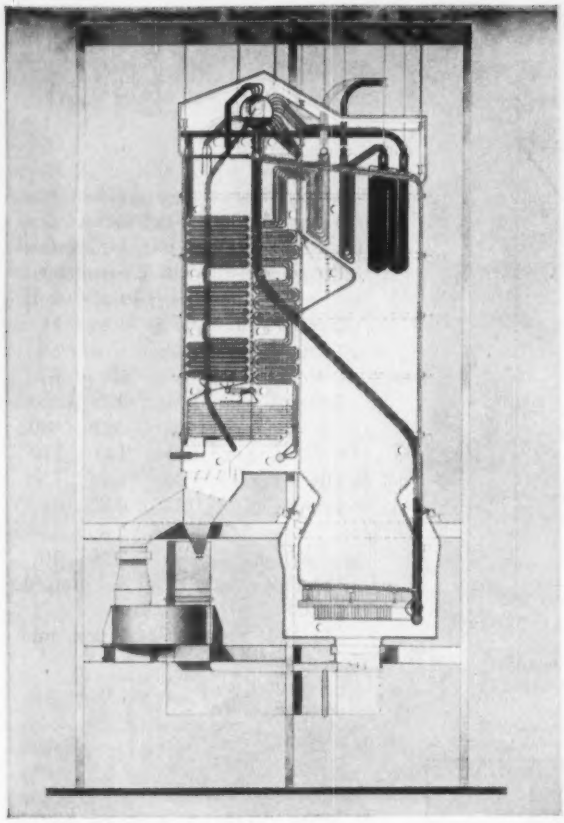
(4) This falls to right of surface loss curve, so try $t_s = 200$. This gives $k = 0.572$; $R_1 = 3.49$; and $q = 286$. Plot 286 Btu per sq ft at 200 F (Point E)

(5) Connect the last two points and note that line (DE) intersects the first curve at 210 F and 284 Btu per sq ft. This is the answer.

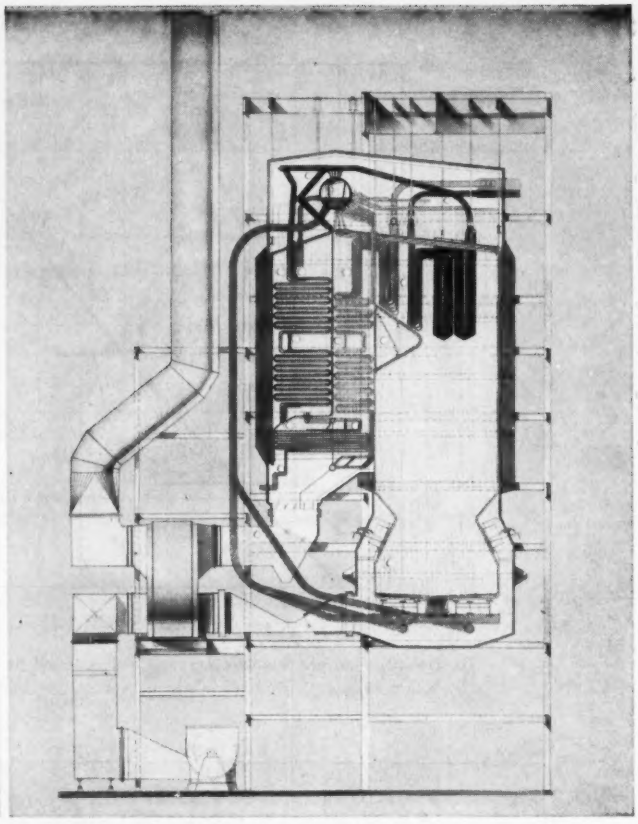
Compound insulation. In some cases it may be desirable to use two or more layers of insulations of different types, as in Fig. 10. The left side of our equation now becomes:

$$\frac{t_i - t_s}{R_1 + R_2} \text{ or } \frac{t_i - t_s}{\frac{x_1}{k_1} + \frac{x_2}{k_2}}$$

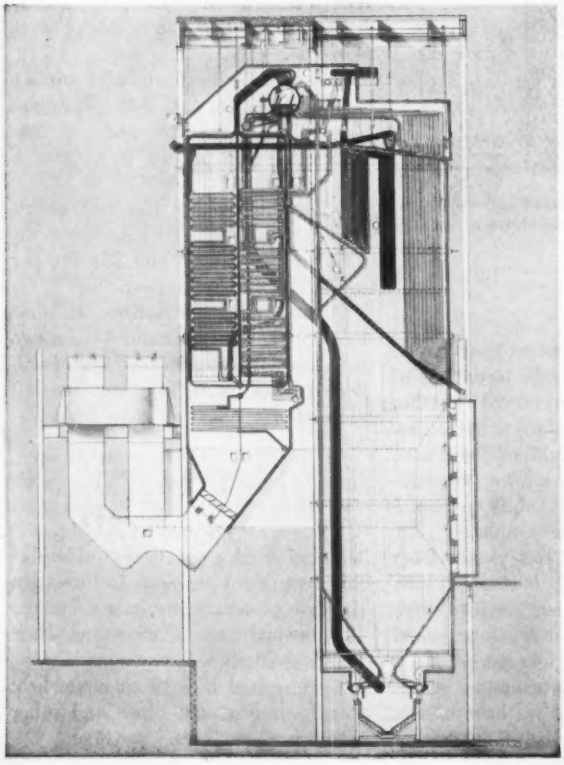
Solution of a practical problem of this type involves more factors than the case of simple insulation, but the fundamental basis is the same. Next month we'll show how to modify the procedure and how to calculate heat loss from insulated pipes and other cylindrical surfaces.

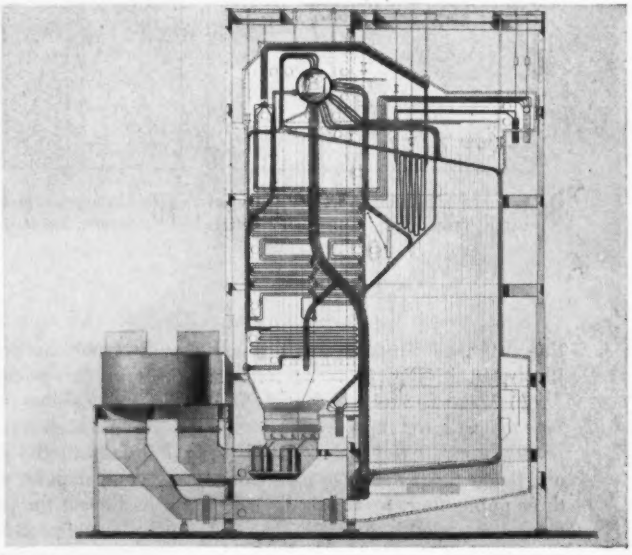


TURBO FURNACE Reheat Unit for **Florida Power Corporation** has capacity of 600,000 lbs/hr. 1750 Psi, 1000/1000 F. Fuels: oil, gas. Could convert to coal with minimum outage. **Black & Veatch.**



This Riley **TURBO FURNACE** Reheat Steam Generator for **Dallas Power & Light Company** is pressurized, has a steam capacity of 1,200,000 lbs/hr. 1005/1005 F. 2125 Psi. Will burn gas and oil initially and convert readily to lignite, coal in future. **Ebasco Services, Inc.**





This 350,000 lbs/hr. Gas Fired Reheat Unit is operating at **Central Louisiana Electric Company's** Teche Power Station. A duplicate is being installed at Coughlin Station. 1650 Psi, 1005/1005 F. Fired by Riley Intertube Burners. **Sargent & Lundy.**

This 690,000 lb/hr. Reheat Unit is now on the line at R. S. Wallace Station of **Central Illinois Light Company** 1650 Psig 1000/1000 F. Fuel: Central Illinois coal. **Commonwealth Associates, Inc.**

NOW Is The Time To Order New Steam Generating Capacity

A new era of growth in the field of power generation is approaching . . . an era that promises to greatly increase the demand on manufacturers of steam and electrical generating equipment. Riley Stoker Corporation, having successfully met the challenge imposed by the remarkable growth of the past decade is now thoroughly prepared to meet the even greater challenge of the new era. Riley is fully staffed and manned in both engineering and manufacturing divisions. Orders placed NOW will be processed efficiently and quickly. Avoid the competition for delivery that may result if the inevitable order is delayed to a time when late delivery may result.

For a more comprehensive discussion of this serious message we refer you to The Management News Letter in the February 2, 1959 issue of Electrical World. We will gladly furnish you with a reprint.

TURBO FURNACE BOILERS THOROUGHLY FIELD TESTED

With the Riley Turbo Furnace thoroughly field tested you can specify the Riley Turbo Furnace Boiler with full confidence that it will live up to its superior performance characteristics. Turbo Furnace Boiler Designs are supplied with Reheat and Non-Reheat and with pressurized and non-pressurized furnaces.

RILEY BOILERS GIVE SUPERIOR PERFORMANCE WHEN EQUIPPED WITH COMPLETE RILEY FUEL BURNING SYSTEMS

Any fuel or any combination of fuels can be burned efficiently with Riley Boilers because Riley also manufactures a complete line of fuel burning products. For pulverizing coal Riley offers two types of mills: the Riley Pulverizer and the Riley Ball Tube Mill. These are used with either Riley Flare Type Gas/Oil/Coal Burners with Riley wall fired units, or with Riley multiple fuel Directional Flame Burners with the Turbo Furnaces. Riley also furnishes spreader stokers, traveling grate stokers and underfeed stokers. A Riley Boiler installation complete with Riley fuel burning equipment assures a contract of undivided responsibility.

RILEY PROVIDES FULLY EQUIPPED AND SKILLED CONSTRUCTION SERVICES

Riley Stoker Corporation supplies complete construction services with its equipment. Riley construction crews employ the latest in construction methods and techniques.

EXPERIENCED SERVICE ENGINEERS ASSURE SAFE, DEPENDABLE AND EFFICIENT OPERATION OF RILEY BOILERS

Riley Service Engineers are trained to provide prompt and efficient servicing of all Riley installations. These experienced engineers work closely with your operators to assure that your Riley equipment will operate at high efficiency for long uninterrupted periods of operation.

YOU'LL FIND A RILEY REPRESENTATIVE IN EACH OF THESE PRINCIPLE CITIES:

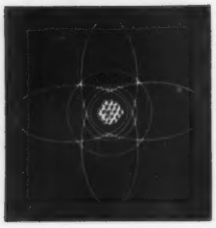
Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Jacksonville, Kansas City, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Salt Lake City, San Francisco, Seattle, St. Louis, St. Paul, Syracuse, Worcester.

RILEY STOKER CORPORATION, WORCESTER, MASSACHUSETTS

A survey of your plant by a qualified consulting engineer could show ways of making surprising savings in your power costs.

RILEY

STEAM GENERATING & FUEL BURNING EQUIPMENT



Nuclear notes

By B G A SKROTZKI, Associate Editor

Homogeneous reactor, known as Los Alamos Power Reactor Experiment No. 2 (LAPRE-II), began running March 16 at the AEC's Los Alamos, New Mexico, Scientific Laboratory run by the University of California. The reactor will check feasibility of using solution of enriched uranium phosphate, phosphoric acid and water as fuel and relying on natural circulation of solution to carry the heat to a heat exchanger to produce superheated steam. Reactor is designed to produce an output of one mwt. Gold interior cladding protects structural parts from corrosion by the solution. LAPRE-I, dismantled in 1957, had excessive corrosion in the heat exchanger and used a circulating pump between reactor and heat exchanger. No. 2 has cylindrical gold-lined stainless-steel pressure vessel about 4-ft tall with 15-in. dia. This also encloses the heat exchanger. Fuel temperature rises to 800 F in operating range, high enough for superheating turbine steam at medium pressure.

Standardizing nuclear-reactor materials will be discussed in a series of forums sponsored by the American Society for Testing Materials. First forum will be at Haddon Hall Hotel, Atlantic City, N. J. at 2 pm on Thursday, June 25, during ASTM's 62nd Annual Meeting. Second forum will be held in San Francisco, Calif., from Oct 11 to 16, during the ASTM 3rd Pacific Area National Meeting. All members and nonmembers interested in this work are urged to attend.

"International problems of financial protection against nuclear risk," a report by a Harvard research team, discusses the international liability problem. The study was made under auspices of the Atomic Industrial Forum and the Harvard Law School. Report can be purchased from the Forum, 3 East 54th Street, New York 22, N. Y. at a cost of $6 per copy.

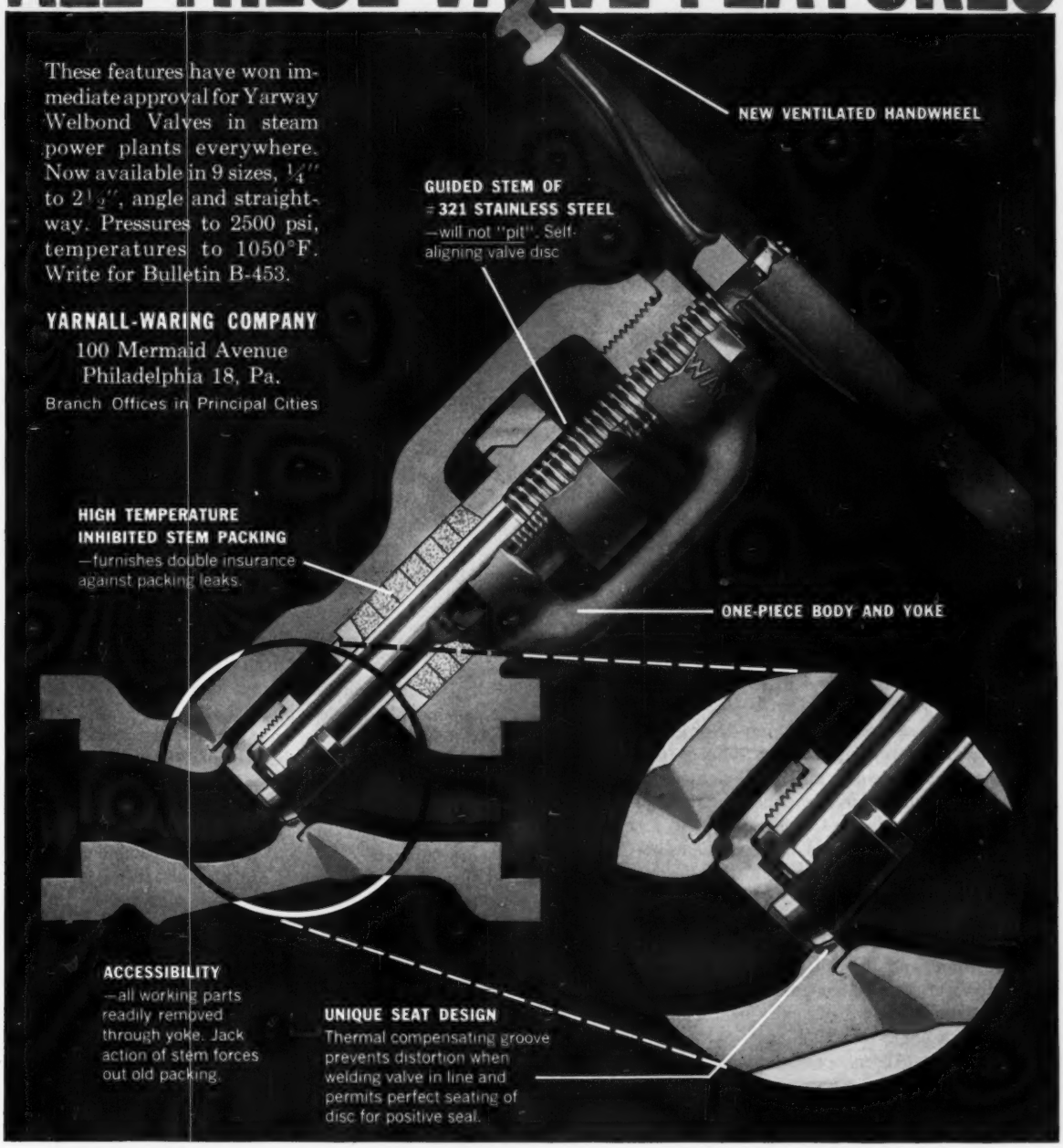
About $100 million worth of goods for atomic-energy activities were shipped by privately-owned plants during 1957. Breakdown includes: radiation-monitoring devices, $16 million; reactor vessels and tanks, $10 million; reactor control equipment, $9.5 million; fuel elements, $8.6 million; valves, $7.8 million; pumps, $6.1 million; heat exchangers, $8.3 million; control and measuring devices with isotopes, $6.0 million; completely assembled reactors, $5.7 million. The survey did not include construction, engineering and design, research and development, standard products and materials not specifically designed for nuclear work. Almost 200 companies returned information for the survey.

Uranium-ore reserves for U.S. were estimated at 82,500,000 tons on January 1, 1959. This compares with about 78 million tons estimated a year earlier. Concentration of U_3O_8 runs about 0.26% as an average in this ore. There are 23 uranium processing mills in operation with a daily capacity of 21,065 tons of ore; investment in these mills runs about $135 million.

AEC invites proposals for development program leading to nuclear superheat reactors. The proposals considered will be cost type contracts for engineering development work leading to designs and materials. Allis Chalmers, Westinghouse and General Electric have already announced studies that indicate success in nuclear superheating. Proposals must have been received by AEC by April 20.

Dresden reactor vessel has been delivered to its site. Built by Shipbuilding Corp of Camden, N. J., the reactor vessel is 42-ft high, 12-ft dia with walls of 5⅛-in. carbon steel lined with ⅜-in. of stainless steel for corrosion protection.

ONLY WELBOND® COMBINES ALL THESE VALVE FEATURES


These features have won immediate approval for Yarway Welbond Valves in steam power plants everywhere. Now available in 9 sizes, ¼" to 2½", angle and straightway. Pressures to 2500 psi, temperatures to 1050°F. Write for Bulletin B-453.
YARNALL-WARING COMPANY
100 Mermaid Avenue
Philadelphia 18, Pa.
Branch Offices in Principal Cities
NEW VENTILATED HANDWHEEL
GUIDED STEM OF 321 STAINLESS STEEL
—will not "pit". Self-aligning valve disc
HIGH TEMPERATURE INHIBITED STEM PACKING
—furnishes double insurance against packing leaks.
ONE-PIECE BODY AND YOKE
ACCESSIBILITY
—all working parts readily removed through yoke. Jack action of stem forces out old packing.
UNIQUE SEAT DESIGN
Thermal compensating groove prevents distortion when welding valve in line and permits perfect seating of disc for positive seal.

YARWAY WELBOND ... *is the valve for high pressures/high temperatures*

REPRESENTATIVE USERS OF YARWAY WELBOND VALVE: Houston Lighting & Power Co. Jersey Central Power & Light Co. Boston Edison Co. Virginia Electric & Power Co. Connecticut Light & Power Co. City of Independence, Mo. Aluminum Co. of America City of Pasadena, Calif. Mississippi Power & Light Co. Rochester Gas & Electric Corp. Ohio Edison Co. Central Hudson Gas & Electric Corp.

For more facts circle 238 on Reader Service card, p 97

Reserved for your comment

BOB BELLAS, Associate Editor

Fogbound

Some time ago you published an article by J Stephen Ungar, Assistant Chief Performance Engineer, Consolidated Edison Co, on a fog-making machine used for finding boiler air leaks, etc ("Find those costly boiler-casing, condenser leaks," Jan 1957, pp 114-115). I found this article to be very interesting, particularly as we have obtained one of these machines at our station.

Mr Ungar stated, "This machine, mainly used for locating boiler air leaks, was used for finding condenser air leaks by injecting fog into the condenser steam space through the vacuum-breaker line."

I am unable to understand this because the fuel used for fog-making is an oil, and the fog made tends to leave an oily deposit on anything it contacts. This oily deposit would be the last thing you would want on the steam side of your condenser tubes.

I would like to have any information you could give me as to how Mr Ungar gets around this undesirable effect. I am anxious to use our machine for finding condenser leaks, too. Fuel we are now using is a hydraulic fluid.

H A FRANCOM, *Charge Engineer*
Bromborough Power Station
Central Electricity Generating Board, England

EDITOR'S NOTE: *To clarify the issue for Reader Francom and others who may have wondered about advisability of injecting an oil-base fog into condensers, we went to the feedbox. Steve Ungar says:*

"The fluid we use for generating fog is a synthetic lubricant made by Celanese Corp of America and is known by its trade name as Cellulube 220. Ingredients of this fluid are chiefly phosphates. Careful exploration and testing indicate that the fluid in fog form does not deposit readily on the surfaces which it contacts. The liquid and the fog are fire resistant and, for all practical purposes, nontoxic. However, to preclude possibility of boiler-feedwater contamination we normally overboard the condensate for about 5 to 10 minutes of the startup period. There have been occasions when no overboarding was used, with no resultant contamination of boiler feedwater in our high-pressure boilers. To date we have had no feedwater contamination resulting from using Cellulube 220 as a fog for finding leaks in many condensers in five large generating stations."

Pulverizing tactics

I was extremely interested in Mr Elmendorf's views on pulverizer design ("Why pulverizer design needs updating," Jan 1959, pp 72-74) and I agree with Mr Schueler (*Comment*, Feb 1959, p 84) on our need for idealists. But if I may, I'd like to express my opinion of the situation as I see it.

Major use of pulverized coal today is in steam-generating units having capacities ranging from 200,000 to approximately 4,000,000 lb steam per hr. In units of any size, particularly those mentioned above, it is impossible to separate the design of pulverizers from the design of the steam-generating unit, including burners, furnaces, superheaters and reheaters. Classification of coal fed to the furnace is certainly of considerable importance, but this importance must not be overemphasized to the detriment of the overall design.

It has been the aim of every pulverizer manufacturer at all times to produce a classification containing a minimum of plus-50 mesh material for the required minus-200 mesh material consistent with overall economics of plant operation. Tests run by numerous utilities indicate that with midwestern coals 65 to 70% minus the 200 mesh with approximately 1.5% on the 50 mesh gives the greatest economy of overall performance. This, of course, will depend on firing method and furnace type used. So far as combustion efficiency is concerned, firing method preponderantly used by our company involves a loss ranging from 0.1 to 0.5%.

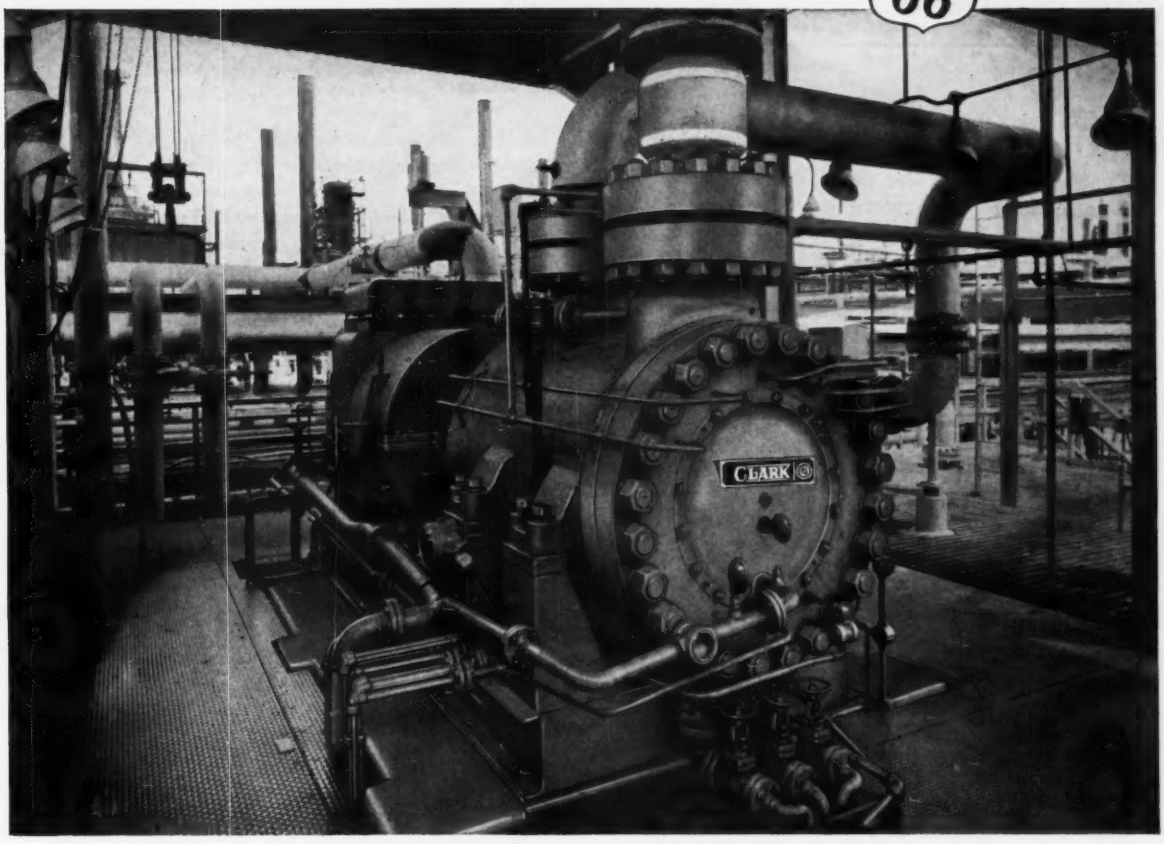
Pulverizer manufacturers have of necessity been concerned with designing larger pulverizers to meet the requirements of ever-larger steam generators. This buildup has not been one solely of physical increase. Pulverizer designs have been and are being continually improved by all major pulverizer manufacturers. New materials, as they are introduced, are being used. This is best indicated by the fact that maintenance costs on our pulverizers in 1958 were exactly the same as those obtained in 1940. This has been accomplished in the face of a great increase in labor and parts cost and deterioration in coal quality during this 18-yr period. Where maintenance costs are high they should be stressed, but, with our pulverizers, total maintenance cost runs from 3 to 5 cents per ton. Power cost is more important than maintenance since it runs approximately twice this figure.

The article referred to low-grade fuels such as lignite and coke breeze and their use depending so heavily on reducing pulverizer maintenance. It seems peculiar to lump coke breeze and lignite in a single category when referring to maintenance, since our experiences on lignite indicate that maintenance is approximately one-third of that on average bituminous coals.

A BOGOT, *Assistant Mgr, Fuel Equip Div*
Combustion Engineering, Inc

continued

AT PHILLIPS PETROLEUM CO.



First full-scale PENTANE ISOMERIZATION plant uses Clark Barrel-Type Centrifugal Compressor

Isomerize normal pentane to permit the use of natural gasoline as a high octane blending stock? Why not, said Phillips Petroleum Company. Normal Pentane was one of the remaining major components of natural gasoline that could be upgraded. Furthermore, the low sensitivity of isopentane together with its high octane level made it an ideal blending agent in premium gasoline.

By-passing the usual prototype size unit, Phillips built the industry's first full scale pentane isomerization plant. The plant uses Universal Oil Products Company's Penex Process employing a platinum-containing catalyst. With a design capacity of 34,400 bbl. per day of pentane reactor feed, the plant can produce about 16,000 bbl. per day of 95% isopentane. Startup was smooth and design yields were quickly reached.

To handle the hydrogen recycle phase of the process at the Borger, Texas plant, a Clark Vertically-Split Multi-Stage Centrifugal Compressor was selected. While the ratio of hydrogen to hydrocarbon is low in this process, the high feed capacity requires 2,000 hp for hydrogen circulation. As in many other similar processes, the performance of this Clark compressor has from startup met the rigid design requirements.

CLARK®

ONE OF THE DRESSER INDUSTRIES

For complete details on Clark Vertically-Split Compressors, write for Bulletin 150.

COMPRESSORS AND GAS TURBINES

CLARK BROS. CO., OLEAN, NEW YORK

For more facts circle 239 on Reader Service card, p 97

More **comment**

Market analysis

If you wanted to give this article ("Why waste heat," March, p 89) something more than propaganda value, why didn't you give some comparative cost figures?

Fuel and electricity are not the only charges. How about amortizing the NEW capital equipment?

FRANZ MISCH, *Washington, D.C.*

EDITOR'S NOTE: *Anxious to get a first down here, we called a pass play and sent Author Sturges in motion. Statistical result:* "In amplifying charges involved in heat-recovery equipment installed in the New Canaan supermarket, total cost to the owner was $3300. If we take the current prices of fuel oil and electricity in this area, we get annual cash savings as follows:

6500 gal @ 15.6c	$1014.00
13,860 kwhr @ 2c	277.20
Total annual savings	$1291.20

On the basis of our estimates, this installation will pay for itself in 2.58 yr. However, this supermarket needed additional heating equipment which was supplied by our heat exchanger. To install heating plant and radiation necessary to supply 120,000 Btu per hr would cost at least $1000. So this can be credited as a reduction of total cost."

Don't be half-safe

We've just finished a sixth reading of "How much is 6 × 0?" *(George Edwards,* March 1959, p 196).

We are well aware of the sincere approach of POWER editors which permits printing "brickbats" as well as "bouquets." This is what we consider "freedom of the press" and so long as the articles printed are sincere, well thought out, and backed by knowledge of the subject, we are in favor of it.

In reading various publications issued by boiler-insurance companies you must have seen (as we have) articles mentioning percentage of low-water failures traced to "human failure." We're not sure of the percentage generally quoted, but believe it's in the vicinity of 74%. This, then, certainly backs up George Edwards' statement that correcting the human error is the biggest single job to be performed before boilers are really safe.

We subscribe to insurance company thinking that a second low-water cutoff (*separately piped*) does, indeed, add to total "safety" of boiler operation. Edwards' article said: "Insurance people I talked with are against it in principle, but they are up against causes they can't control. So they are taking the only road left."

We believe there are other "roads." For instance, a tremendous responsibility attaches to the manufacturer of such controls. Every conceivable effort must be put forth to make the instrument as safe as modern engineering design can make it. Too, with each and every control there must be furnished completely adequate, easy-to-read easy-to-understand instructions for proper installation and maintenance of the controls. Manufacturers must be ready and willing to furnish up-to-date construction, installation and maintenance literature to insurance companies so they can fully inform their inspectors. Certainly these "roads" take some time, but diligent efforts of control manufacturers and boiler insurance companies must eventually have far-reaching effects.

BRUCE RANNEY
Magnetrol, Inc, Chicago, Ill.

. . . Does 6 × 0 equal 0, or does 1 + 1 equal 99.9%? I believe that most of your readers, experienced boiler people and Mr Edwards will agree that my formula of 1 + 1 = 99.9% greater safety is almost as accurate, decidedly more constructive.

I agree with Mr Edwards that one float type low-water cutoff, if properly maintained, will give good protection and that any additional cutoffs of the same type will fail, eventually, along with the first if they receive no maintenance.

For years we have firmly believed that two low-water cutoffs are an asset to any boiler. We also realize that two cutoffs of the same type are not the best protection available. However, by choosing an electric-probe type for the second cutoff, we believe we have given our customers a much greater factor of safety.

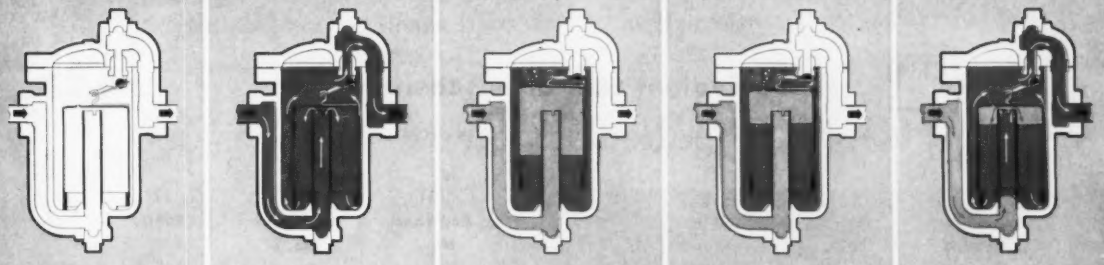
A float type cutoff can fail to function if scale and sludge hamper mechanical linkage action, or if piping between boiler and control becomes clogged. However, an electrical-probe type cutoff has no linkage and is mounted directly in the boiler drum. If the electrode itself becomes corroded and scaled, and contact cannot be made with the boiler water, then the cutoff will fail, but will fail with the boiler in a safe condition.

We recommend that the float type cutoff be the primary unit with attached switch as the feedwater pump controller. The probe type unit mounted directly in the boiler drum is a secondary cutoff and set to operate below the level of the float type pump control and low-water cutoff.

While I agree wholeheartedly with Mr Edwards that maintenance is the prime consideration, I believe that two cutoffs of different design afford the boiler owner a much greater factor of safety regardless of type of maintenance. It should be remembered that any mechanical device, even though maintained with great care, can fail.

DON H HAMILTON
Superior Combustion Industries, Inc

This simple trap operating principle provides the efficiency, dependability and freedom from maintenance necessary for the most profitable use of steam



When trap is first installed, the inverted bucket is down and the valve is wide open.

When steam is turned on, condensate (solid color) flows into trap and out through discharge orifice, until —

Steam (light color) reaching the trap floats the inverted bucket and closes the valve.

When more condensate enters the trap, the bucket loses buoyancy and pulls on valve lever.

When weight of bucket times leverage overcomes pressure on valve, bucket sinks and opens trap.

Key: condensate steam steam bubbles air bubbles

ARMSTRONG INVERTED BUCKET STEAM TRAPS

are designed and made to give you these big benefits:

● Amstrong Traps, the first inverted bucket steam traps, now represent the most advanced development of this time-proven principle. They provide all the advantages necessary for efficient, economical condensate drainage from virtually all types of steam using equipment.

1. *No steam loss* – Steam never reaches the orifice even when there is no condensate load.
2. *Automatic air elimination* – Vent in trap bucket passes air and other non-condensibles through to be discharged with condensate.
3. *No cooling leg required* – Condensate is discharged at steam temperature as fast as it reaches the trap because trap operates on difference in density between steam and water not on temperature.
4. *Operates on any back pressure* — Failure of one trap in system will not cause others to open because high back pressure does not affect an Armstrong trap other than to reduce capacity. As long as there is a pressure differential across the orifice the trap will close on steam and open for condensate.
5. *Unaffected by ordinary dirt* — Swirling action of condensate keeps dirt in suspension until discharged with condensate, prevents it from lodging in valve.
6. *Completely dependable* — Proved design plus the use of all stainless steel working parts assure continuity of service and length of service unmatched by any other trap.
7. *Big capacity in a small, economical package* — Armstrong design gives you the highest practical capacity for any given pressure. And remember, Armstrong capacity ratings are based on *hot* condensate at the *working pressure differential* stated, not on theoretical orifice capacities.

Further information on these advantages plus much additional information is given in the 48 page Armstrong Steam Trap Book. Ask your local Armstrong Representative or write direct.

860 Series for low pressure heating service.

800 Series, side inlet, side outlet.

No. 801, side inlet, bottom outlet.

880 Series, integral strainer.

200 Series, bottom inlet, top outlet.

Forged Steel Series for high pressures, high temperatures.

The 48 page Armstrong Steam Trap Book tells how to correctly size, install and maintain steam traps for any pressure, any temperature, any load plus full catalog data on Armstrong Steam Traps. Ask for Catalog K.

ARMSTRONG MACHINE WORKS

8128 Maple Street • Three Rivers, Michigan

For more facts circle 240 on Reader Service card, p 97

Power's data sheet

No. 321

Equivalent fuel oil viscosities

(1) Commercial standard	(2) Pacific coast standard	(3) Saybolt seconds universal	(4) Saybolt seconds fural	(5) Redwood No. 1	(6) Redwood No. 2	(7) Engler
2	—	30	—	—	—	—
2	—	35	—	32.2	—	—
2	200	40	—	36.2	—	—
4	200	45	—	40.6	—	1.32
4	200	50	—	45	—	1.42
4	200	55	—	49	—	1.49
4	—	60	—	54	—	1.57
4	—	70	—	63	—	1.71
4	—	80	—	71	—	1.84
4	—	90	—	80	—	1.98
4	—	100	—	89	—	2.1
4	—	125	—	110	—	2.4
5	—	150	—	134	—	2.7
5	—	175	—	155	—	3.0
5	—	200	—	177	—	3.5
5	300	250	—	220	—	4.2
5	300	300	—	270	—	4.8
5	300	400	—	360	—	6.1
5	300	600	33	530	—	8.5
5	300	800	40	700	140	11
6	—	900	45	800	145	12
6	400	1650	75	1500	260	21
6	400	2400	100	2100	400	28
6	400	3800	150	3400	560	42
6	400	5000	200	4500	950	60
6	400	6500	250	6000	1300	70
6	400	8500	300	7500	1600	85

(1) Commercial standard CS-12-48, U.S. Department of Commerce, No. 3 (40-45 ssu) and "Cold 5" (125 to 200 ssu) have no official standard but these viscosity limitations are normally accepted
(2) Western United States
(3) Measured in seconds at 100 F (38 C)
(4) Measured in seconds at 122 F (50 C)
(5) Measured in seconds at 100 F (38 C)
(6) Measured in seconds at 86 F (30 C)
(7) Measured in degrees at 50 C (122 F)

By S D DISTELHORST, Reading, Pa.

© POWER

News and Notes on...

Good Packing Practice

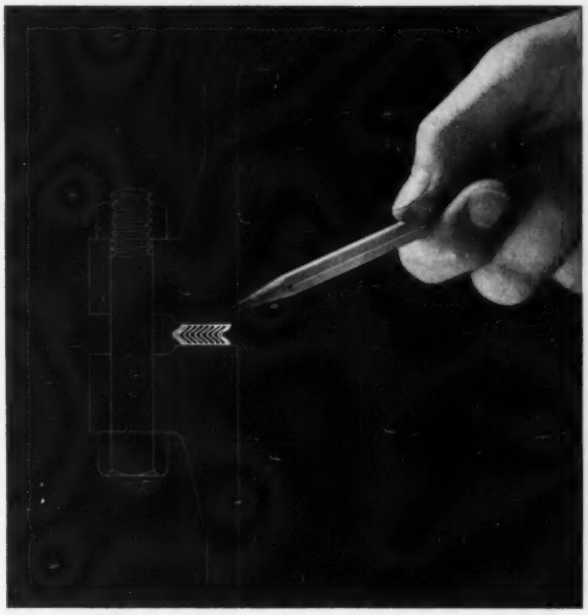
JOHNS-MANVILLE JM PRODUCTS

Maintenance and Design Hints from Johns-Manville Packings and Textiles Dept.

Subject of the month: Selecting the Gasket

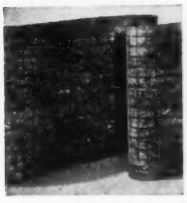
Question:

What are the important points to remember about gasket applications so we can avoid costly failure?

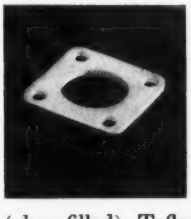


GASKET engineering is a complex study, but there are certain simple answers to this commonly asked question. Briefly, at least three variables must be considered. These are: 1. The available bolt force on the gasket. 2. Internal pressure and temperature. 3. The nature of the contained fluid.

Starting with bolt force: it must be adequate to flow the gasket material and cause it to yield and seat effectively. Secondly: the bolt force must also always be sufficient to exceed the internal pressure and temperature forces that work against gasket closures. Finally: the gasket material must be impervious to the action of the confined fluid.

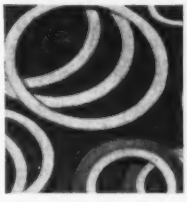


For service at low to medium temperatures and pressures: As a rule of thumb, if multiplying the operating pressure (psi) by operating temperature (°F) results in a product not exceeding 250,000, a quality "general service" type gasket can be used with complete safety. An outstanding gasket material for these operating conditions is J-M Service® Sheet #60 . . . a tough, durable compressed asbestos sheet. Service Sheet seals effectively against hot or cold water, steam, oils, mild acids and caustics.



If corrosive fluids are encountered: The best solution to the constant attack of chemicals and solvents is a gasketing material that is chemically inert. For this kind of service condition, Johns-Manville Teflon* Chempac® Gaskets are recommended. They are available in pure Teflon, low-flow (glass-filled) Teflon, Teflon-Asbestos, and in metal-Teflon combinations.

*TM for DuPont Tetrafluorethylene resin.

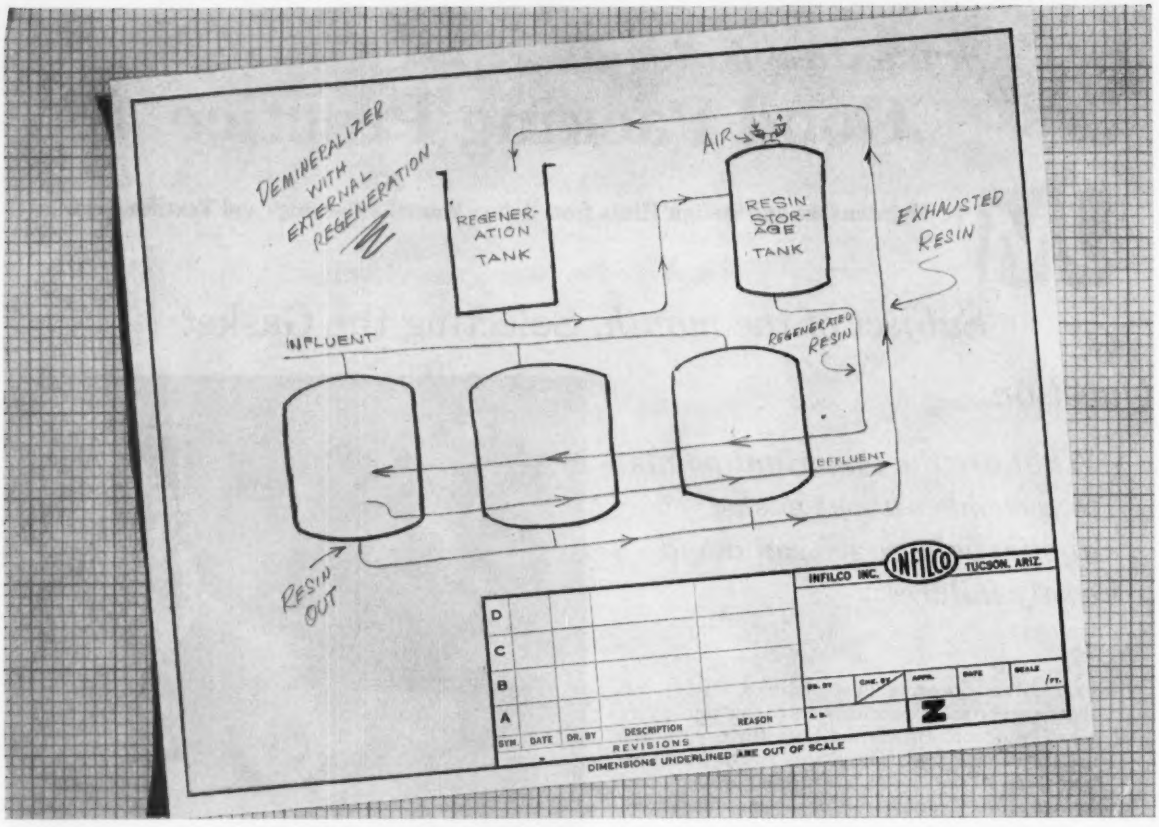


When extreme pressures and temperatures act on the gasket: If internal pressures reach 1200 psi or temperatures exceed 850°F, safe practice calls for a sturdy gasket that offers the high resiliency needed to follow expanding and contracting movements of flanges. For standard flange applications to 6,000 psi, you will find metal-asbestos, spiral-wound Goetze Spirotallic® gaskets most efficient. They offer high mechanical strength and resilience. Their special interlocking design and stainless steel construction is especially designed to effect and maintain a tight seal despite wide pressure and temperature variations.

To solve any sealing problems, call your J-M Packings and Gaskets field representative. He's equipped to give you information on new products . . . engineering and design advice. For information on any J-M Packings or Gaskets write Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario.

JOHNS-MANVILLE

For more facts circle 241 on Reader Service card, p 97



ADVANCED demineralization equipment

...for specialized applications

Varied and increasingly stringent demineralized water requirements necessitate custom-made methods and equipment for many applications. Through the years INFILCO has furnished equipment for many of these "problem" jobs. These are typical examples—

INFILCO furnished the *first* high flow rate demineralizers (50 GPM per square foot) to polish condensate for a nuclear power reactor. This equipment has been operating successfully for over a year at the Vallecitos Atomic Power Plant of General Electric Company and Pacific Gas and Electric Co.

A similar INFILCO plant, having a capacity of 3200 GPM at 50 GPM per square foot, with complete external regeneration facilities, will polish condensate for the 180,000 KW dual cycle boiling water reactor at the Dresden Nuclear Power Station of Commonwealth Edison Company. This plant is discussed in Reprint 88.

Now INFILCO can furnish equipment, using these modern operating and regeneration techniques for large raw water demineralizers to produce high quality water, with less investment than would be required with other types of equipment. Reprint 92 tells the complete story.

If you have a demineralization problem, we can help you solve it efficiently and economically. If our standard line of equipment does not meet your particular requirements we can offer a custom designed plant to do the job.

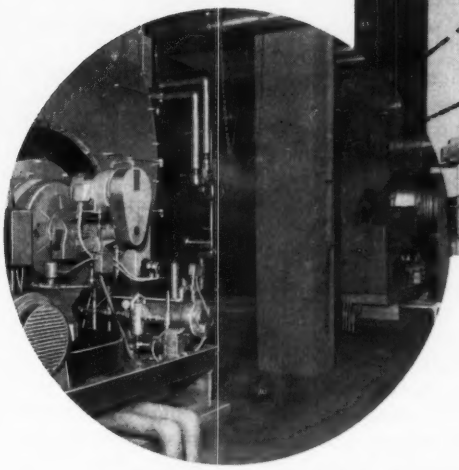
INFILCO

9501

INFILCO Incorporated
General Offices:
Tucson, Arizona

Field Offices throughout the United States and other countries

Where the *steam* comes from



...for Mutual Benefit Life's fine new buildings in Newark, N. J.

Complete firing system in one package. Every factor that affects firing efficiency is engineered into the unit at the factory. The unit includes: (1) Single or dual-fuel burner, with complete fuel handling systems. (2) Forced draft air supply. (3) Enclosed control panel, with instruments mounted, factory wired and tested, and with signal lights and gauges that afford a complete reading at a glance. In the oil-gas units, fuels can be switched automatically, or with the simple flick of a switch.

Fire low cost residual oils

The heavy residual fuel oils (No. 5 and 6) have higher heat value than light heating oils, yet cost less per gallon.

The Iron Fireman boiler-burner units shown here fire these sluggish oils with complete dependability. They protect against fuel emergencies because they can fire *any* grade of oil, light or heavy.

Gas or oil—switch fuels instantly

Dual-fuel models fire either gas or oil, and can be switched either by manual or automatic controls. In some areas gas rates are substantially less for customers whose steam plants switch automatically from gas to oil firing when outdoor temperature falls below a certain level, relieving the load on main gas lines when demand is highest.

Fires all types of boilers

Iron Fireman residual oil firing (with or without gas) is available in complete boiler-burner units ready for service connections, or as a package firing system that can be applied to any type of boiler.

Send coupon for further information

IRON FIREMAN®

AUTOMATIC FIRING EQUIPMENT

FOR OIL - GAS - COAL

IRON FIREMAN MANUFACTURING COMPANY
3131 West 106th Street, Cleveland 11, Ohio
(In Canada, 80 Ward Street, Toronto, Ontario)

Please send information on Iron Fireman forced draft firing for oil, gas or oil-gas combination.

Name_____

Address_____

City_____ State_____

For more facts circle 243 on Reader Service card, p 97

Technical briefs . . . Latest engineering

Citric acid turns in a good cleaning job on main h-p boilers at Philo Station

Organic acids for cleaning power-plant equipment, *C M Loucks, Dowell Div, The Dow Chemical Co, E B Morris, American Electric Power Service Corp and E A Pirsh, The Babcock and Wilcox Co*

Organic acids did two internal cleaning jobs on Unit No. 6 at the Philo Station of AEP in Oct and Dec of 1957. Decision to use organic acids resulted after a series of lab and field tests in which citric and formic acids were compared. (Tartaric acid was tested in the lab but rejected for field testing because of formation of an insoluble reaction product on the metal surfaces used in the tests.)

Citric acid got the nod over formic acid for the cleaning job at Philo. Although cleaning abilities of both were similar in field tests (which involved 400,000-lb-per-hr boilers) experimenters found that citric was easier to handle, left no precipitated sludges, and deposits citric did leave were softer.

The two cleaning operations at Philo (one for removing mill scale, the other for removing operational iron-oxide) turned in good results. Tube samples showed complete removal of deposits. Importance of tests is that organic acids have turned in a good job in high-pressure boiler cleaning. Experiments at Philo don't indicate a sudden upsurge in the popularity of citric or similar acids for cleaning purposes. Inorganics will still be the workhorses in the acid-cleaning field, but organic acids should prove useful in special applications. *ASME paper 58-A-282*

Shot cleaning—its development and use for cleaning economizers, tubular air heaters and applicable boiler sections, *R E Chappell, Diamond Power Specialty Corp, R D Meyer, Philadelphia Electric Co*

Authors give background on development of shot cleaning, then get into description of typical systems. The major areas of a shot-cleaning system are distribution, hoppers and shot separation, and shot conveyance.

Authors also detail an application of shot-cleaning equipment on 950,000-lb-per-hr, 1800-psi 1000-F boilers at the Delaware Station of Philadelphia Electric Co. They summarize the advantages of shot cleaning, based on this and other uses proved in service. *ASME paper 58-A-104*

Directions for ordering these papers on page 92

Computers

Generalized steam power plant heat balance for digital computer application, *Alexander Zabludowsky, Stone and Webster Engineering Corp*

During the past decade the digital computer has become an important tool in solving engineering problems. Greatest advantage from a computer is gained when solving highly repetitive problems involving large amounts of calculation. However, many such problems are poorly defined in terms of a generalized solution procedure. This points up the main need for efficient computer programs if we are to get full value from a digital computer.

Importance of thorough generalization is twofold: the more general the statement the less change is needed to solve for a new set of conditions, and generalized statements can be programmed without the programmer needing excessive familiarization with the engineer's job.

Author illustrates the general statement using a steam-cycle heat balance, dividing balance into three major parts—turbine cycle, connections and heater cycle. *ASME paper 58-A-213*

The application of computers to the small power plant, *E S Monroe Jr, E I du Pont de Nemours and Co, Inc*

Automatic computers can be applied economically to the small power plant. Areas showing greatest potential for this application are (1) safety, from a reliability viewpoint (2) investment cost reduction (3) energy costs (4) labor costs.

Use of computers can often reduce investment costs by helping to obtain the best standard design for industrial power-plant equipment. They help cut energy costs by analyzing best places to trim consumption in production end, not by trying to boost boilerhouse efficiency. Labor savings fall in the clerical and routine engineering areas. Data processing for load forecasting and running heat balances is faster and yields more data than if done by manual methods, allowing better management decisions. *ASME paper 58-A-230*

Power generation

1958 year-end summary of the electric power situation in the United States, *Edison Electric Institute*

Report lists the kilowatt capability, system and station of each of the 114 thermal and 45 hydraulic units of 4000 kw and larger added during 1958. About 11.7 million kw of new additions are thermal (83%) and 2.4 million kw are hydraulic (17%).

Discussions and tables of data on the installations are broken down into the eight power supply regions

of the United States, as defined by the Federal Power Commission. Price of report is 50 cents per copy. *EEI publication 59-121*

1957 report on oil and gas engine power costs (*data for 1956 and previous years*). *American Society of Mechanical Engineers*

The 1957 report contains operating cost data on 104 plants. Data includes 49 plants totaling 142 dual-fuel engines and 19 gas-engine plants with a total of 65 gas engines.

Performance and production costs of oil- and gas-engine power plants are listed from 1929 through 1957. Returns from survey are listed for 1957 in one section, and data for previous years is listed in a different section. All returns for 1956 and before from any one plant are listed together so comparison can be drawn for one plant over a number of years rather than many in one year.

Production cost, as relating to plants, is defined as consisting of the following items: fuel cost, lubrication cost; cost of attendance and superintendence; cost of supplies and miscellaneous; cost of engine and all other plant repairs. Price of report is $3.00, with 20% discount to *ASME* members.

Maintenance

EDITOR'S NOTE: *Tenth Annual Plant Maintenance and Engineering Show was held week of Jan 26, 1959 in Cleveland. Papers presented then will be available in book form this summer. Since papers are not available individually they are not numbered*

Maintenance materials, *K N Banthin, Visking Co division, Union Carbide Corp*

Since the end of World War II many new materials have appeared which are applicable to problems of corrosion control, equipment maintenance, process improvement and structure protection. Some applications for these are protective coatings for structures, production equipment, floors and safety equipment. Nine structure and sixteen equipment coatings, nine pipe materials and linings and miscellaneous protection applications are discussed in detail, with application hints, reasons for selection.

Economical use of electric power, *P A Dethloff, Continental Can Co*

In order to understand and analyze his power bill the utility customer should understand the language of terms and contracts. Fuel adjustment, transformer rental, power factor and demand energy are explained. An example of the relation between energy costs and demand costs as they affect the power bill is given, using a plant with a heavy first shift, medium second shift and light night shift. A method is included for estimating the charge against total electric bill of air-conditioning equipment, lights, production equipment and essential building equipment that is seldom shut down.

Setting and maintaining sanitary objectives, *K Bowman, Delco-Remy division, General Motors Corp*

Sanitation in plants is defined as cleanliness in its broadest sense. The bill for this cleaning effort in industry runs over four billion dollars a year, and estimates show that about 30%, over one billion dollars, is wasted because of failure to recognize inherent savings.

The first area to explore when looking for savings is labor, which runs up to 92% of the cleaning bill. Any sanitation program should consider (1) the degree of cleanliness required or desired (2) effective use of supervision and manpower (3) methods and application procedures (4) control and use of equipment and material.

In June 1954 Delco-Remy started a sanitation system which anticipated a 15% saving in costs over the previous system. It took two supervisors one month to set up the program for a plant of 1500 employees. It was another three to six months before the program was working smoothly. The steps taken in developing the program as well as program's aims are detailed here.

Counteracting air and water pollution, O C Thompson, *Union Carbide Chemicals Co division, Union Carbide Corp*

There are three major problem areas in any effective air- and water-pollution control program: how to handle the plan within the plant, how to deal with people outside the plant and the technical problems of cleaning waste from the various plant discharges.

A written policy is a must to keep clear the program's aims: who is responsible for what, how the program will be carried out and who will deal with the public. This should be followed by a program to interest the employees in pollution control and get their help in achieving it. Posters, articles in plant bulletins and group training in equipment operation and maintenance all help create interest. And these steps are just as necessary as similar steps taken to create effective safety programs.

Cooperation with local industries and civic leaders, health officers and other public agencies can often be a big help. Many times the public doesn't understand steps a plant is taking to achieve pollution control and these outside people can step in and explain what's going on and why the community should be patient. Employee education, plant visits, informing enforcement agencies on what you're doing, prompt handling of complaints and good press relations all take effort but also pay off.

continued

B&O
The only fuel that's
sure to give you all 3!
CONSTANT SUPPLY
CONSTANT EFFICIENCY
CONSTANT LOW COST
B&O
BITUMINOUS COALS FOR EVERY PURPOSE
Ask our Man! BALTIMORE & OHIO RAILROAD, BALTIMORE 1, MD. Phone LExington 9-0400

Technical briefs

Begins on page 86

Maintenance by outside contractors, *P M Kimmell, Eastman Kodak Company*

Three guideposts to a decision between contract and do-it-yourself maintenance are (1) availability of proper skills or tools, particularly in the smaller plant (2) wide variations in the man-hour work load (3) lower cost. The first two of these guides vary widely in importance from plant to plant. There are some skills a plant seeks that a contractor could not justify supplying, so the plant must train its own men to do the job. On the other hand there are many skills that can easily be supplied by contractors — maintenance work on refrigeration, high-voltage equipment, machine rebuilding and control repairs.

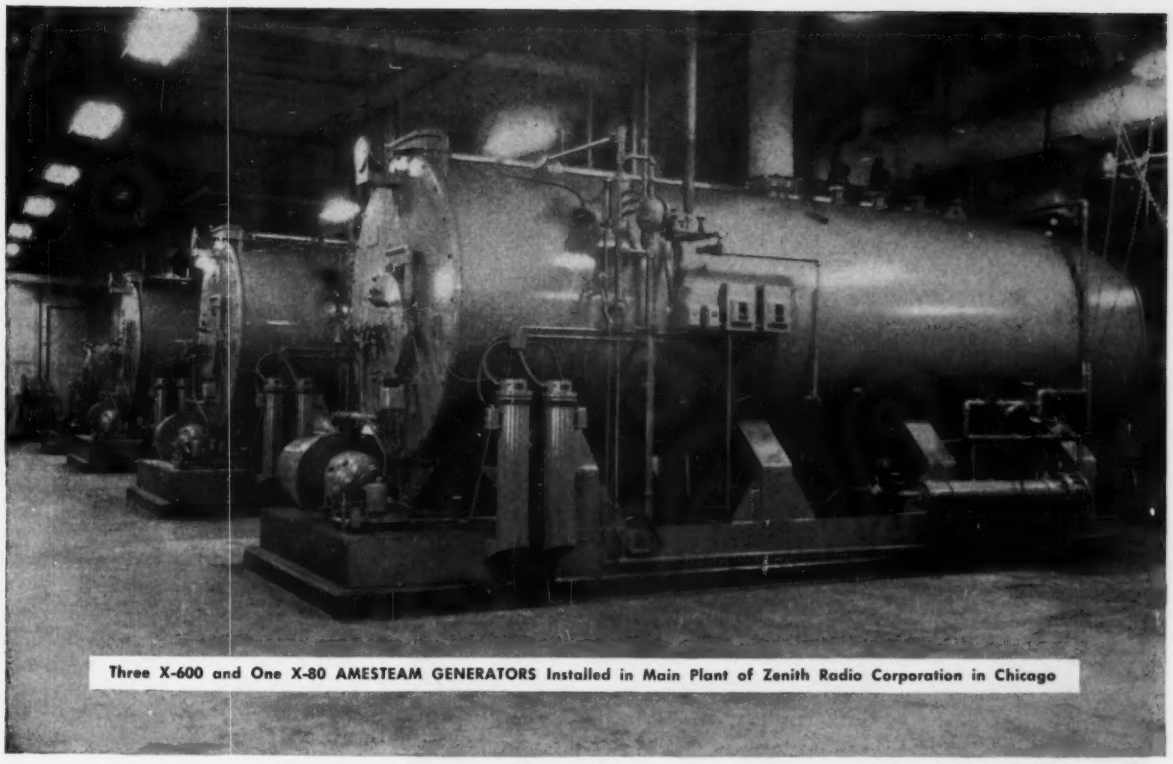
Costs are one thing on which you can get concrete information. To start a cost survey first become familiar with the accounting procedures your plant uses. Then compare your costs to those of the contractor. (1) Get the rate paid each of the main categories of your labor force. Find out from the accounting department how much of the burden assigned to your department is fixed and how much variable. The variable part includes maintenance, labor costs, fringe benefits.

There are less tangible factors also: travel time of the contractor, a greater feeling of responsibility and stronger desire to go a good job among your own employees than among outside help brought in temporarily, familiarity of your employees with equipment and accepted standards.

If you decide on contract maintenance you'll get more for your money if you provide your own maintenance engineering and planning group; inspectors for fire, safety and preventive maintenance; liason between your company and the contractor. In a talk on the same subject at this meeting N M Brown, Pennsalt Chemicals Corp, pointed out that a thorough check of the contractor from a business viewpoint will help protect you from risky contracts. Check his insurance coverage, Workman's-Com-

Directions for ordering papers on page 92

For more facts circle 244 on Reader Service card, p 97



Three X-600 and One X-80 AMESTEAM GENERATORS Installed in Main Plant of Zenith Radio Corporation in Chicago

AMESTEAM GENERATOR PERFORMANCE

BRINGS REPEAT ORDERS FROM ZENITH RADIO

"We wish to advise you of our satisfaction with the four AMESTEAM GENERATORS installed in our main plant in Chicago."

So writes Mr. G. R. Price, Superintendent of Maintenance, Zenith Radio Corporation.

"These Ames boilers are in their third full season of operation, and we are very pleased with their performance. They have proven remarkably free from operating trouble, and we rely on their automatic operation without maintaining an engineer on duty.

"Combustion efficiency is excellent, and we are able to operate these AMESTEAM units through the entire heating season without opening rear baffle or cleaning tubes until the summer check-up.

"To indicate our satisfaction with your equipment, we have installed a 300 HP AMESTEAM unit and two 125 HP AMESTEAM units in other locations, since the original installation in the main plant."

This, along with hundreds of other letters in our files, proves that AMESTEAM GENERATOR customers are *repeat* customers. Why is this so consistently true? Because AMESTEAM GENERATOR Automatic "Package" Boilers are recognized throughout industry for their ability to deliver *low-cost steam,* efficiently, dependably, over a long period of years.

WHAT'S YOUR STEAM PROBLEM?

If you need 10 to 600 HP and want the kind of space-saving, trouble-free service enjoyed by satisfied owners of AMESTEAM GENERATORS, write today for our catalog and the name of your nearby AMESTEAM Dealer.

AMES IRON WORKS INC.
BOX H-59 OSWEGO, N. Y.

For more facts circle 245 on Reader Service card, p 97

MAINTENANCE CUT 90%

ACE Rubber-Lined Ash Pipe

. . . saves 20 days a year turning and patching pipe at New Haven Railroad's Cos Cob Power Plant

Cinders and fly-ash pouring down this 300-ft. long pipe from the ash handling system of the New Haven Railroad's main power plant quickly scoured holes in cast iron pipe. To save trouble, the heavy pipe was rotated ⅛th of a turn every three months, a few sections at a time. The job took five days.

Then Ace rubber-lined pipe was installed. Its remarkable abrasion resistance kept it in service for three years before turning! Even then, its light weight made it possible to turn 200 ft. at once, finishing the job in one day instead of five.

Ace pipe, lined with rubber developed especially for ash systems, offers *you* these savings too. It's one of *nine* types of Ace plastic and rubber pipe made for tough jobs.

AT LAST! A PERMANENT CURE FOR CONDENSATE RETURN LINE CORROSION

Extensive tests show Ace Tempron pipe... rigid, heat-resistant nitrile hard rubber ...is immune to hot, corrosive steam condensate. Ask about it.

AMERICAN HARD RUBBER COMPANY
Division of Amerace Corporation
ACE ROAD · BUTLER, NEW JERSEY

ACE

Technical briefs

Begins on page 86

pensation record, type of time and material records he keeps, and his labor relations—whether his men are union or freelance.

Electrical systems

Auxiliary system for a supercritical unit: a design based on a tested system for a subcritical unit, *J P Fitzgerald, C F Paulus and H A Vargas, Cleveland Electric Illuminating Company*

In a unitized plant, once provision has been made for a separate auxiliary power source for startup and shutdown, the next step is to provide automatic emergency transfer of auxiliaries from one source to another. An auxiliary system of multiple boards and transformers yields high reliability at low cost for large subcritical units. System then provides a base for economically supplying auxiliary requirements for a large supercritical unit.

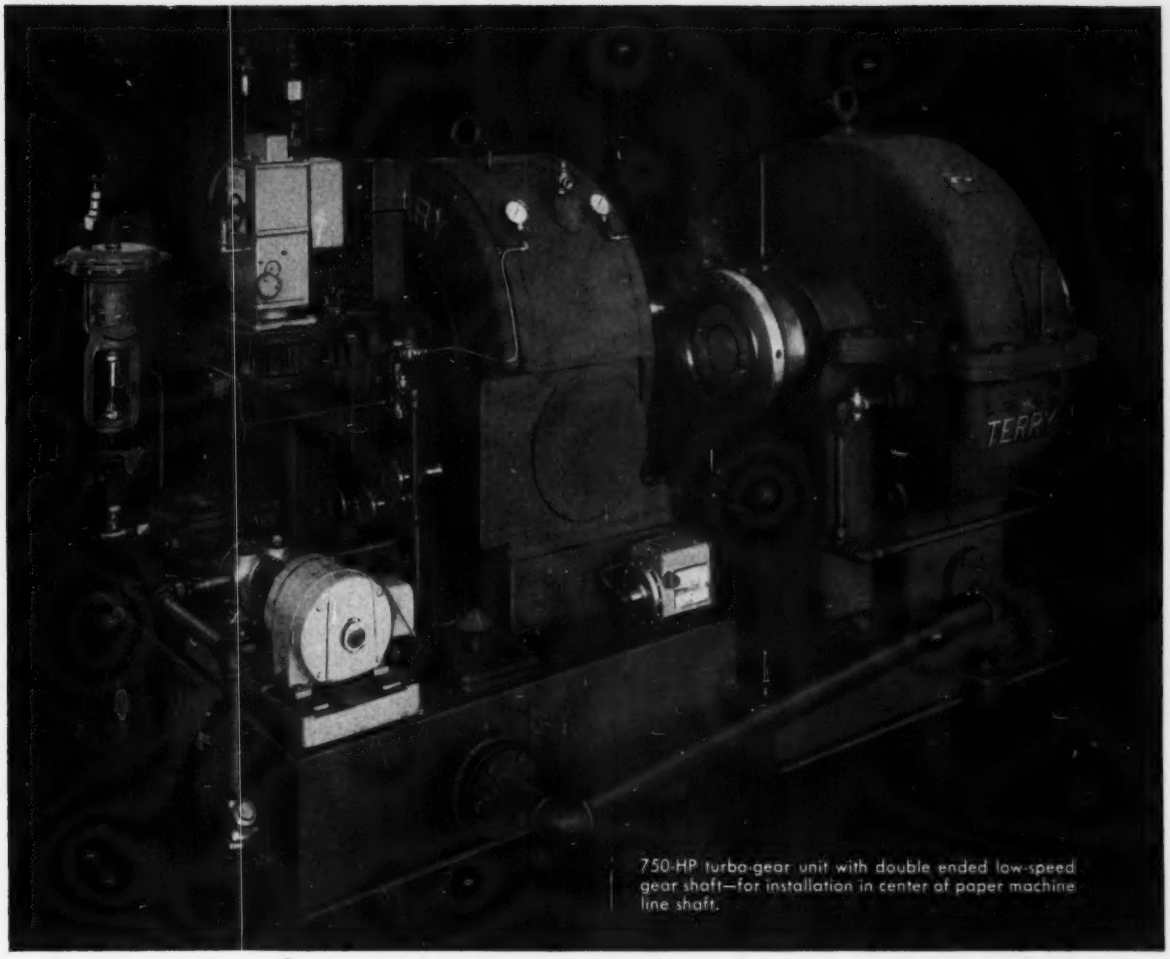
Paper considers the design of an auxiliary system for a large supercritical pressure unit based on a tested system used for very large subcritical units presently in service. Modifications to the basic system are developed. Special emphasis is placed upon developing the principles governing automatic transfer following a unit tripoff, and a method is presented. Calculations to determine critical transfer times are developed and verified by a full-scale test.

Major modifications for the supercritical unit include tandem-motor boiler-feed-pump drive and more rapid automatic transfer following unit tripoff. Time required to complete an automatic transfer was calculated and verified by test. The transfer on the 250-mw supercritical Avon Unit No. 8 will be completed in about 1.5 seconds. *AIEE paper 59-215*

Electrical control features of the Avon supercritical pressure plant. *By R F Willett, Cleveland Electric Illuminating Company*

This paper describes the major electrical-control features of the company's Avon Unit No. 8—a tandem

Directions for ordering papers on page 92



750-HP turbo-gear unit with double ended low-speed gear shaft—for installation in center of paper machine line shaft.

LOW-SPEED TURBINE DRIVES

tailored to meet your requirements

For more than half a century, Terry has been one of the principal suppliers of turbo-gear units for driving slow-speed fans, generators, paper machines, large pumps and the like. Each unit is designed to meet the job requirements. The paper-machine drive illustrated is a good example of this *individualized engineering.*

In service at a large southeastern paper mill, the unit delivers 750 HP at 3350/500 RPM, with steam conditions of 450 lbs., 660°F and 50 lbs. back pressure. Equipped with a variable-speed governor, operated by remote control, the speed of the unit may be varied through a 10:1 range. Other features include forced-feed lubrication to turbine and gear bearings, and automatic shutdown and alarm in case of low oil pressure.

Whatever *your* requirements for low-speed turbine drives, a Terry engineer will be pleased to discuss them with you. Bulletin S-140 covers the full line of Terry turbines; Terry gears are described in bulletin S-130.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TERRY

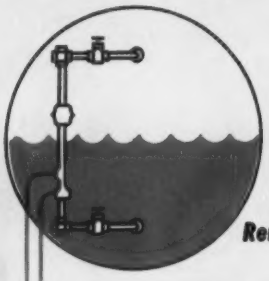
TT-1212

For more facts circle 247 on Reader Service card, p 97

Know all your water levels—*every minute*—

with the help of

Reliance EYE-HYE®



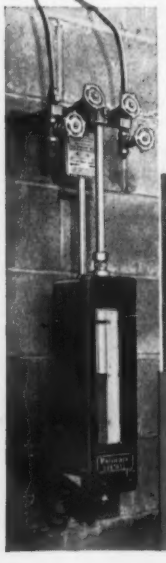
Remote indication saves time—increases safety

Any water-containing vessel is a potential hazard, whether it's fired or unfired. For most efficient control, *gages for all vessels should be out in the open, or at control stations.*

Where remote reading gages should be used:

Stationary power boilers
Feed water heater tanks
Waste heat boilers
Surge tanks
Water treatment systems
Heating boilers
Storage tanks
Marine power boilers

What you should expect in a remote reading water level indicator	Reliance EYE-HYE
Flexibility of placement. Gage reading precisely where most convenient to use — even above the boiler.	✓
Sharp visibility. Easy to read green indicating fluid, illuminated.	✓
Scientific accuracy. U tube manometer principle for laboratory exactness.	✓
Simplicity. Smooth hydrostatic action — no mechanical working parts.	✓
Safety. Invites frequent reading — an aid to preventing water level accidents.	✓
Easy installation. Flexible tubes from boiler to gage window.	✓
Low maintenance. Scheduled cleaning only at infrequent intervals. Easy to blow down.	✓



Write for Bulletin CO and learn how EYE-HYE can increase the reading efficiency of all your liquid levels.

The Reliance Gauge Column Company
5902 Carnegie Avenue • Cleveland 3, Ohio
Representatives in all principal cities

Technical briefs

Begins on page 86

compound turbine-generator rated at 215 mw and operated at throttle conditions of 3500 psig, 1100 F, with single reheat to 1050 F; C-E Sulzer monotube once-through steam generator rated at 1,715,000 lb per hr; turbine-driven and tandem motor-driven boiler feedwater pumps; selective tripping and transferring of auxiliaries; automatic-starting features of selected pumping apparatus; special protective features of the steam cycle; integrated boiler-turbine-generator trip protection. The major mechanical and electrical features have been described in previous papers.

In summary, the author states that (1) basically, the overall trip protection for the supercritical-pressure turbine and steam generator is not radically different than for large subcritical units (2) automatic transfer of selected auxiliary motors to the start-up source becomes more important (3) the monotube and once-through steam generator requires a large number of hydraulic and remotely operated electrical controls (4) automatic starting of boiler feed pump prime movers and other auxiliaries may increase the overall reliability of the main unit while adding little complexity to the control system which is designed for complete remote operation (5) complexity and quantity of electrical controls required on main control-room panels for a supercritical unit far exceed those required for a large conventional high-pressure high-temperature unit. *AIEE paper 58-53*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the following sources unless otherwise stated. Order complete paper from source, not POWER.

American Society of Mechanical Engineers. Identified by initials ASME, and obtainable through ASME, 29 W 39th St, New York 18, New York.

American Institute of Electrical Engineers. Identified by initials AIEE and obtainable through AIEE, 33 W 39th St, New York 18, New York.

For more facts circle 248 on Reader Service card, p 97

POWER POINTERS

257,500,000,000,000 BTUs

SINCE INSTALLING ONE OF THE COUNTRY'S FIRST HIGH PRESSURE FEEDWATER HEATER SYSTEMS, AN EASTERN POWER PLANT HAS CONVERTED OVER 10¼ MILLION TONS OF COAL INTO BTU'S. YET NOT A SINGLE MONEL TUBE IN ANY OF THE HEATERS HAS BEEN REPLACED. HEATERS OPERATE AT 2000 PSI WATER PRESSURE, USE STEAM AT 900° F STRONG MONEL* NICKEL-COPPER ALLOY RESISTS CORROSION, PERMITS USE OF RELATIVELY THIN-WALLED TUBING FOR MAXIMUM HEAT EXCHANGE.

¼ billion flexures in chlorinated water

...Monel check valve springs still springy

IN 1932, 3,450 MONEL CHECK VALVE SPRINGS WERE INSTALLED IN A METROPOLITAN WATER PLANT'S FOUR LARGE PUMPS. PREVIOUSLY, STRESS-CORROSION BECAUSE OF CHLORINE IN THE WATER CAUSED CRACKING AND FAILURE OF SPRINGS, SHORTENED THEIR LIFE TO 3 YEARS OR LESS. TODAY, OVER 90% OF THE ORIGINAL MONEL SPRINGS ARE STILL IN SERVICE, MANY AFTER 25 YEARS AND OVER A QUARTER BILLION FLEXURES.

The metal that comes back from Davy Jones' locker

MONEL ALLOY TAGS CLIPPED TO PUPS' FLIPPERS COME BACK FROM THE DEEP TO TELL A TALE OF THE MIGRATIONS OF SEAL HERDS. THE U.S. FISH AND WILDLIFE SERVICE FINDS MONEL ALLOY RETAINS IDENTIFYING MARKS FOR AS LONG AS 12 YEARS DESPITE SALT-WATER CORROSION AND ABRASION FROM ROCKS AND SAND.

Slowed down by a metal problem?

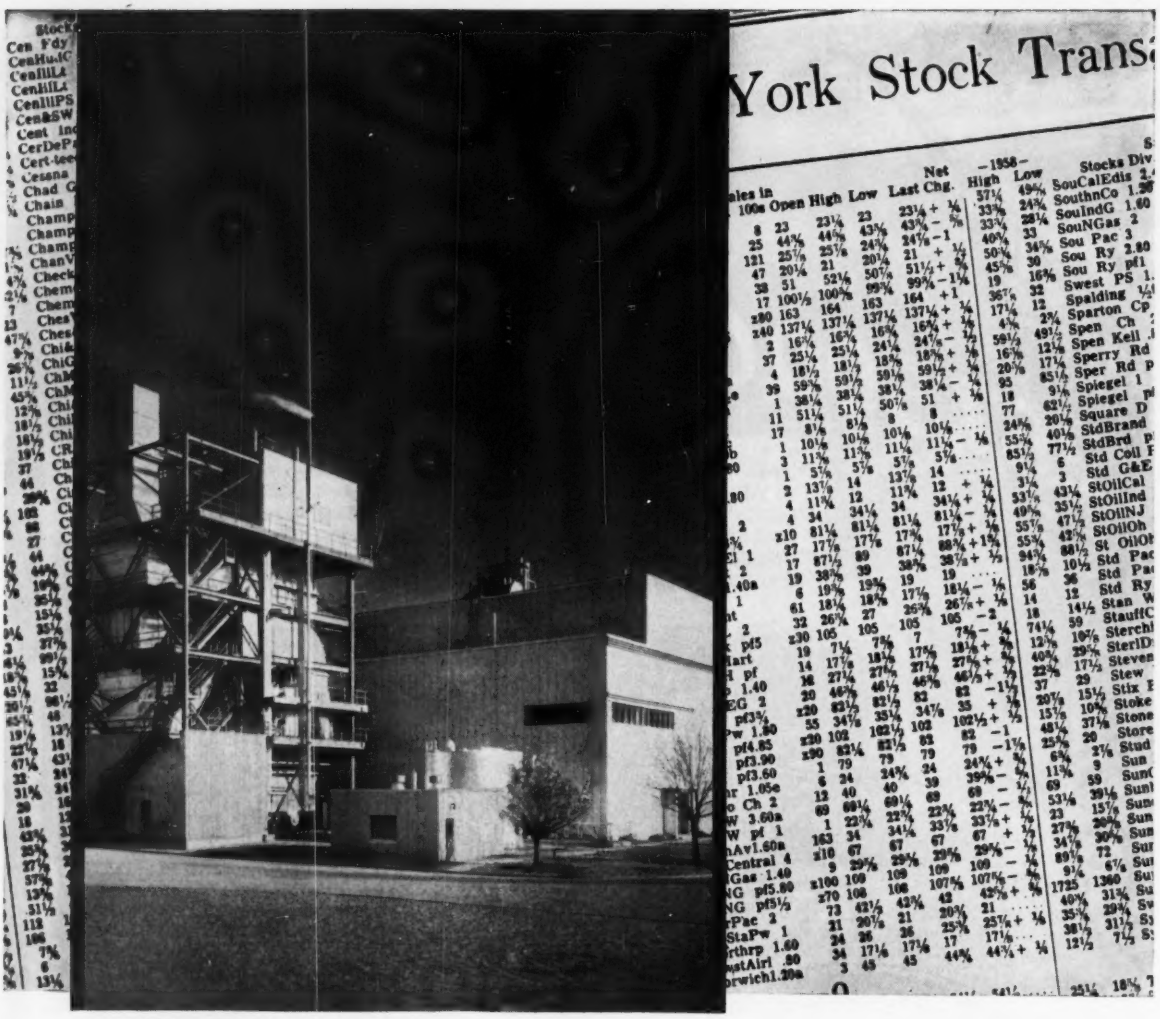
A TALK WITH ENGINEERS FROM INCO'S MECHANICAL ENGINEERING SECTION MAY HELP YOU GET BACK ON SCHEDULE. JUST GET IN TOUCH WITH US AND OUTLINE THE DETAILS. AND FOR A USEFUL RUN-DOWN ON MONEL ALLOY, WRITE DEPARTMENT **P.** FOR 30-PAGE INCO BULLETIN, "ENGINEERING PROPERTIES OF MONEL AND 'R' MONEL ALLOYS".

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO TRADE MARK

*Registered trademark

INCO NICKEL ALLOYS



50,000 kilowatt central station built for Southwestern Public Service Company.

Solving the paradox of power plant construction through Pritchard's GOOD FINANCIAL DESIGN

How much should you invest in power facilities? This question has a double-edged answer. If you aim for lowest plant cost, the result can be poor efficiency and high operating costs. On the other hand, building for the best heat rate can run costs so high that the completed plant may not earn a reasonable return on invested capital.

Building power plants that offer the best solution to this kind of problem is a Pritchard specialty. All of Pritchard's services—ranging from economic studies, engineering and construction, to delivery of a turn-key plant—are focused on good financial design that balances operating costs against capital investment. Examples of Pritchard's skill in striking this economic "balance" point can be found in many power installations over the country.

When you are confronted with the paradox of power plant construction, let Pritchard help you get the most advantageous solution. Pritchard is staffed to submit a turn-key proposal—or can supply design, engineering or construction services separately.

PROFITABLE FACILITIES THROUGH GOOD FINANCIAL DESIGN

J. F. Pritchard & Co.

ENGINEERS • CONSTRUCTORS

Dept. 408, 4625 Roanoke Parkway, Kansas City 12, Mo.

OFFICES IN CHICAGO, HOUSTON, PITTSBURGH, NEW YORK

SERVING THE GAS, POWER, PETROLEUM AND CHEMICAL INDUSTRIES

For more facts circle 249 on Reader Service card, p 97

O-B VALVES

this disc holder can save you money...

Keep the disc from grinding against the seat when you close a valve and the disc lasts longer. It's as simple as that to save money.

Composition discs in O-B globe and angle valves are securely held in free-swiveling, self-leveling disc holders. When a valve is being closed, the stem and disc holder turn as a unit until the disc is firmly seated and stops rotating. As the stem continues to turn it exerts downward pressure on the disc, closing it leak-tight. There is no grinding or gouging between seat and disc... and disc wear is kept to a minimum.

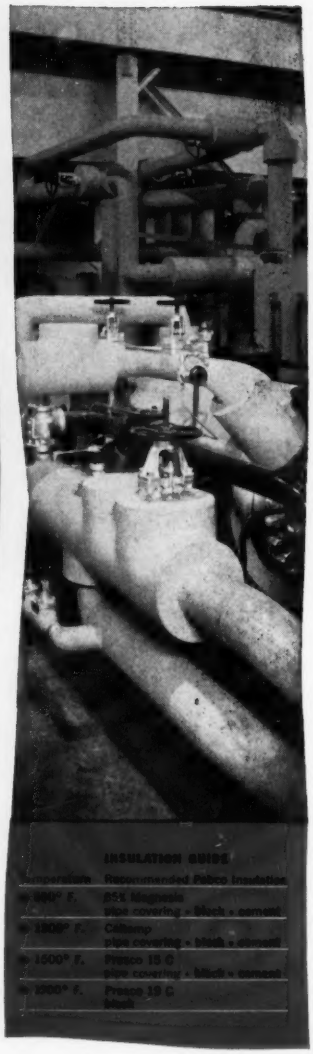
This free-swivel disc action is just one of the many ways O-B bronze valves help industries keep maintenance costs down, production up. If you aren't using O-B valves ask your local Ohio Brass distributor to show you the complete line, or write to Ohio Brass Company, 380 North Main St., Mansfield, Ohio.

For more facts circle 251 on Reader Service card, p 97

Complete control of temperatures with

PABCO PRECISION-MOLDED CALTEMP

a Calcium Silicate Insulation



Name your temperature. A performance-proved Pabco pipe or block insulation will maintain it at economical levels up to 1900° F. With Pabco Caltemp, 85% Magnesia, or Prasco Insulations, heat losses are reduced to an absolute minimum . . . finest performance assured. For data on technical advantages, case histories, or engineering consultation . . . write . . . or contact one of Pabco's insulation engineers.

PABCO INDUSTRIAL INSULATIONS DIVISION

Fibreboard Paper Products Corporation • San Francisco 19 • Chicago 54 • Houston 4 • New York 16 • Los Angeles

Your service center for FREE data

Either of the no-postage Reader Service cards below and p 99 will bring you information on any new equipment listed or product advertised, plus new literature for your files

- **Study New Equipment** described in this issue starting on p 110. Circle numbers on card corresponding to items listed
- **Check New Literature** available this month beginning on p 98. To get your personal copies use the card below
- **Read advertisements** and note number listed under each ad. Circle ad numbers on card for complete details
- **Print your name and company on front of card**

May 1959 issue

This card void after August 1, 1959

Circle key numbers below for FREE information on . . .

PLANT EQUIPMENT in the news this month, starting on p 110

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

NEW LITERATURE listed in this issue, starting on p 98

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150
151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175
176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200

ADVERTISED PRODUCTS appearing throughout the issue

201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225
226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250
251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300
301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325
326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350
351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400
401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425
426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450

NOTE TO CIRCULATION MANAGER: I'd like to start getting *my own* copies of POWER monthly. Please enter my subscription for one year at $5 ☐ Make it three years for $10 (a $5 saving) ☐ (In Canada $7 — one year, $14 — three years.) Bill me ☐ Bill company ☐ Payment enclosed ☐

NOTE: Fill in your name and business address on other side of card →

New free literature

AIR CONDITIONING, VENTILATION AND REFRIGERATION

101 **Sprayed-coil dehumidifiers,** draw-through and blow-through types, are topic of 24-p catalog 9427. One section covers principles of blow-through units, application recommendations. American-Standard, Industrial Div

102 **Electronic air cleaners** are subject of 16-p bulletin 258A. High-velocity units are shallow, with small face area. American Air Filter Company, Inc

103 **Filtration felts** for air, gases and liquids are covered in technical data sheet 15. Includes performance, selection info. American Felt Company

104 **Thermoplastic ducting systems** for corrosion resistance are discussed in new folder. American Agile Corporation

105 **Bag type filter** is described in 4-p bulletin 501 BT. Performance chart and specs are included. Arco Manufacturing Corp

106 **Pressure blowers** with variable horsepower and flow are featured in 4-p catalog 1210-2. Westinghouse Electric Corporation, Sturtevant Div

107 **Coating finished insulation** in cooler rooms is topic of 2-p data sheet C-4-A. Benjamin Foster Company

MATERIALS

108 **Titanium** is topic of 36-p booklet. A reference for engineers and designers, book tells how titanium is made, covers advantages, ratings, specs and alloy characteristics. Harvey Aluminum

109 **Technical cements** are discussed in newspaper to be published periodically. How products are used, new products, new applications are among topics covered by the periodical. Sauereisen Cements Company

110 **Wrought iron** use in solving equipment-design problems is described in an illustrated 4-p reprint. A M Byers Company

COMPRESSORS AND ACCESSORIES

111 **Oil-free compressors** for heavy-duty industrial use are subject of 12-p bulletin A-44. Units have capacities from 95.6 to 939 cfm. Joy Manufacturing Company

112 **Compressed-air** and -gas driers are topic of 6-p bulletin R-34. Photos, diagrams, sizing chart and spec tables are included. Desomatic Products, Inc

113 **Compressed-air driers** up to 3000 cfm to handle compressor output to 600 hp are featured in 12-p bulletin D3-1058NE5. Capacity tables, sizing and dew-point graphs, specs, diagrams included. Van Products Company

ELECTRICAL GENERATION

114 **High-speed** synchronous generators are described in 4-p bulletin GEA-6815. Cutaway shows features; photos show installations. General Electric Company

115 **Electrical** and technical characteristics of engine-driven gen-

PLEASE TYPE OR PRINT

Your Name .....

Position .....

Company .....

Co. Address .....

City and State.....

Is this your personal copy of POWER?

Yes ☐ No ☐

FIRST CLASS
PERMIT No. 64
NEW YORK, N. Y.

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY—

Power

READER SERVICE DEPARTMENT

330 WEST 42nd ST.

NEW YORK 36, N. Y.

26th FLOOR

Circle key numbers, page 97, for your copies

erating equipment are covered in educational pamphlets M-100 to 103. Operation and use are discussed. D W Onan & Sons Inc

ELECTRICAL DISTRIBUTION

116 **Thin-wall** flexible Teflon tubing is described in 4-p bulletin. Continental-Diamond Fibre Corp

117 **Motor control center** is described in 6-p bulletin. Photos illustrate safety, compactness and flexibility of units. Electric Distribution Products Inc

118 **Primary distribution system,** overhead type, is featured in 20-p technical brochure RCP-790. Detailed data is given on spacer unit, adapters, phase conductors and messenger. Rome Cable Corporation

119 **Low-voltage** distribution equipment is listed in 84-p catalog GEC-1100. Circuit-breaker load centers, fuse-puller panels, safety switches are included. General Electric Company, Distribution Assemblies Department

120 **Master unit substations** to solve protective, transformation and switching problems in industrial and utility power-distribution systems are detailed in 58-p publication GEA-3800D. System reliability, flexibility, engineering, installation, ratings and dimensions are some topics covered. General Electric Company

ELECTRICAL APPLICATION

121 **High-speed synchronous motors** —design features, construction and applications—are described in 4-p bulletin GEA-6814. General Electric Company

122 **Lighting-control line** for simple intensity control is discussed in 4-p bulletin 76N. Ward Leonard Electric Co

123 **Pushbutton stations** and pilot lights are described in 2-p data sheet 14B7814B. Allis-Chalmers Manufacturing Company

124 **All-weather** mercury pushbutton stations are subject of bulletin 800-C. Tigerman Engineering Co

125 **Control line,** 0 to 4, is featured in 6-p booklet 14B9182. Design features of basic starter and field-modification kits are covered. Allis-Chalmers Manufacturing Company

126 **Lighted indicator** and pushbutton switch devices are listed in 20-p catalog 67. Parts snap together to form combination switch-indicator devices. Minneapolis-Honeywell Regulator Co, Micro Switch Div

127 **Helical gear-motors** and speed reducers are described in 16-p bulletin GEA-6704. Cutaways show maintenance features. General Electric Company

128 **Adjustable-speed drive** in ¾- to 7½-hp range is covered in 6-p bulletin 2750. Cutaway, specs, wiring diagram are included. The Louis Allis Co

129 **Metal poles** and wall-bracket units with disconnecting and lowering mechanism for one-man servicing are topic of brochure PWB-59. The Thompson Electric Company

continued

May 1959 issue

This card void after August 1, 1959

Circle key numbers below for FREE information on...

PLANT EQUIPMENT in the news this month, starting on p 110

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

NEW LITERATURE listed in this issue, starting on p 98

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150
151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175
176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200

ADVERTISED PRODUCTS appearing throughout the issue

201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225
226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250
251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300
301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325
326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350
351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400
401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425
426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450

NOTE TO CIRCULATION MANAGER: I'd like to start getting *my own* copies of POWER monthly. Please enter my subscription for one year at $5 ☐ Make it three years for $10 (a $5 saving) ☐ (In Canada $7 — one year, $14 — three years.) Bill me ☐ Bill company ☐ Payment enclosed ☐

NOTE: Fill in your name and business address on other side of card →

NEW FREE LITERATURE continued ..... circle key numbers, page 97, for your copies

HEAT EXCHANGE

130 **Feedwater heaters** for bleed-steam to feedwater heat transfer are topic of 4-p catalog M-582. Gives photos, diagrams. Southwestern Engineering Company

131 **Use of aluminum** in heat-exchanger fabrication is described in 16-p bulletin 732-1-1. Temperature properties, pressures, dimensional tolerances are covered; charts show aluminum stress values, thermal expansion and conductivity. Reynolds Metals Company

132 **Heat-transfer** products are listed in 4-p brochure 581; tubes used are described. Brown Fintube Company

133 **Admiralty type tubes** with 13% increase in outside surface area are detailed in 24-p new-product catalog. Book lists sizes, alloys, heat-transfer data for many types of integrally finned heat-transfer tubes. Calumet & Hecla, Inc, Wolverine Tube Div

134 **Use of bi-metal tubes** to solve heat-exchanger and condenser corrosion problems is described in 24-p publication. Over 125 bi-metal combinations are given. Bridgeport Brass Company

INSTRUMENTATION

135 **Automatically programmed** remote indication logging system for use with supervisory equipment is detailed in 8-p bulletin GET-2925. Coding, components, physical arrangements are covered. General Electric Company

136 **Network analyzer** available for rental is covered in 8-p bulletin. Unit provides an electrical miniature of almost any power system for studies of system behavior and equipment needs. I-T-E Circuit Breaker Company

137 **Packaged,** centralized custom-engineered control systems are described in 4-p bulletin 159. Protection Controls, Inc

138 **Heavy-duty TV mounts** for acoustical and weatherproof housings are topic of 2-p bulletin 6-98. Cohu Electronics, Inc, Kin Tel Div

139 **Orsat gas analysers** are topic of 12-p brochure 55-668-27. Photos, drawings show units available. The Hays Corporation

140 **Force instrumentation,** data processing and calibration equipment is listed in 2-p bulletin G-100. Gilmore Industries, Inc

141 **Digital instruments** are described in 4-p bulletin 19-36. Includes voltmeters, ratiometers, ohmmeters. Cohu Electronics, Inc, Kin Tel Div

142 **Flow-rate transmitters** are topic of 12-p bulletin 170. Includes capacity tables, diagrams. Brooks Rotameter Company

143 **Btu meter** is detailed in spec sheet 58-B913. System schematic included. The Hays Corporation

144 **Strain gage selection** is topic of 24-p reprint comparing characteristics of resistance gages made by eight firms. Selection criteria are specified. Stein Engineering Services

145 **Etched-foil strain gages** are covered in 6-p bulletin 4320. Detailed tables give limits, specs. Baldwin - Lima - Hamilton, Electronics & Instrumentation Div

continued

PLEASE TYPE OR PRINT

Your Name .....

Position .....

Company .....

Co. Address .....

City and State.....

Is this your personal copy of POWER?

Yes ☐ No ☐

FIRST CLASS
PERMIT No. 64
NEW YORK, N. Y.

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY—

Power

READER SERVICE DEPARTMENT

330 WEST 42nd ST.

NEW YORK 36, N. Y.

26th FLOOR

facts about Superior Packaged Boilers

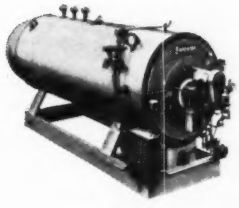
SUPERIOR'S MID-SHELL FURNACE LOCATION

protects against the two most common causes of furnace failure

One of the often overlooked, and yet very important considerations for the purchaser or specifier of boilers of the horizontal fire-tube type is the location of the furnace in relation to the boiler shell. To a great extent this location is determined by whether the boiler is of the up-draft or down-draft type. Up-draft units usually have the furnace set low inside the shell. Down-draft units usually have a higher furnace location.

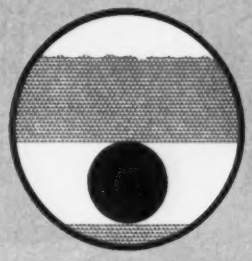
Ideally the furnace is located near the center of the shell, where it is protected from the two most common dangers which can cause bagging, blistering or complete burnout of the furnace.

The first of these dangers is low-water. When the furnace is located too high in the shell, the covering layer of water is necessarily less, and the danger is increased. When the furnace is too low within the shell, mud and silt can deposit on the bottom of the shell and eventually bridge to the bottom of the furnace, cutting off circulation and causing a burnout of the furnace. The adjacent diagrams show the location of the furnace in other fire-tube boilers and in Superior Type C boilers. When you buy or specify a packaged fire-tube boiler consider this important fact.

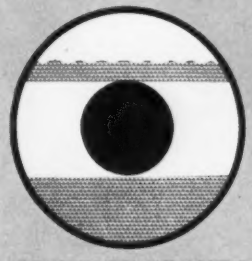


SUPERIOR "TYPE C"
PACKAGED BOILERS

Completely packaged fire-tube units for capacities from 20 to 350 bhp. Rotary burners on all sizes. Induced draft for clean, quiet safe operation. Fully insulated and ready for service burning oil, gas or both in combination. Pressures to 250 psi, or for hot water operation. Other fire-tube models for capacities to 600 bhp. Write today for Bulletin 11C.



LOW FURNACE...MUD BURNOUT DANGER



HIGH FURNACE...LOW WATER BURNOUT DANGER

MID-SHELL LOCATION GUARDS AGAINST BOTH

Specialists in PACKAGED BOILERS... exclusively

SUPERIOR COMBUSTION INDUSTRIES, INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
PACKAGED BOILERS

For more facts circle 253 on Reader Service card, p 97

Interested in "cutting" time?
. . . Then get a
RIDGID
for faster, cleaner cuts on every job!
Five Sizes for ⅛" to 6"
Five Sizes for ⅛" to 4"
RIDGID

For General Use buy RIDGID Heavy-Duty Pipe Cutters

Factory tested for perfect tracking, here's your best cutter buy for hand use. Extra-long shank protects threads, gives fast, easy adjustment Large handle for sure grip . . . more leverage. Strong, special malleable frame won't bend or warp. You'll also need the RIDGID Wide-Roll Cutter, that tracks perfectly at high power-drive speeds, and the RIDGID 4-Wheel Cutters, that give quick, clean cuts in tight places with only quarter turns.

For Tubing and Thin-Wall Conduit buy RIDGID Tubing Cutters

Exclusive fold-in reamer on Nos. 10, 15 and 20 protects hands and pockets . . . reams full cutter capacity. Thin-blade wheel gives quick, clean cuts. Rollers smooth tubing ready for soldering. Special RIDGID No. 315 3-Wheel Cutter gives fast cuts in hard-to-get-at places.

There's a RIDGID Cutter to save you time on every job. Call your Supply House today!

RIDGID

The Ridge Tool Company, Elyria, Ohio, U.S.A.

Free literature

146 **Strain gages,** instruments and accessories are listed in 24-p specification and price list 4310. Includes four pages of gage-dimension drawings. Baldwin-Lima-Hamilton, Electronics & Instrumentation Div

147 **Millivoltmeters,** operation principles, specs, features, are covered in 28-p catalog C10-1. Includes info on control and non-control models. Minneapolis-Honeywell Regulator Company, Industrial Div

148 **Temperature controls** and mounting wells are topic of 8-p booklet MC-177. Specs, dimensions, available modifications are given. Fenwal Incorporated

149 **Dissolved oxygen meter** and its basic components are covered in 4-p product spec sheets 58-B627, -B631 and -B771. System includes contact sampler, analyzer and universal recorder. The Hays Corporation

150 **Gages and accessories** are listed in 38-p catalog AG-1. Cross sections, photos, cutaways are included. International Register Company

151 **Safety gage case** for all high-pressure applications is new feature of firm's pressure-gage line. Entire range of gages is listed in 48-p catalog. Kunkle Valve Company

MAINTENANCE

152 **Thermal insulation,** machine-applied in continuous blanket form, is covered in 4-p bulletin I-10. Columbia Acoustics and Fireproofing Company

153 **Mastic cement** is described in 2-p bulletin 860. Cement is recommended for sealing boiler tube faces, coating oxygen lances. M W Hartung & Associates

154 **Expanded metal partitioning** for enclosures or conveyor guards is described in 4-p catalog. The Globe Company

155 **Plastic vinyl letters** and numbers to eliminate costly stenciling are described in 4-p brochure. M & C Products Co

156 **Tools** for changing incandescent and fluorescent lamps from the floor are covered in 4-p booklet. Phil Rich Fan Mfg Co, Inc, Lamp Snatcher Div

NUCLEAR ENERGY

157 **Nuclear-power** reactor control-system instrumentation is described in 18-p technical publication N-03 (1). Schematics of present, projected reactors are given. Leeds and Northrup Co

Begins on page 98

158 **Nuclear-power plants** as part of electric-utility systems are discussed in 18-p brochure. Specialized problems are outlined. Nuclear Science and Engineering Corporation

159 **Radioactivity's contributions** to industrial progress are outlined in "Radioactivity at work," issue 15. How to get AEC aid for your program is discussed. Nuclear Science and Engineering Corp

MECHANICAL POWER TRANSMISSION

160 **V-belt drives,** *Super HC* model, are subject of 32-p catalog DH-900. Design info is given, plus tables, diagrams, nomographs. The Gates Rubber Company

161 **Replacement belts** for variable-speed units are illustrated and described in 12-p catalog V-173-B. Includes alphabetical listing, interchange guide and conversion tables. Browning Manufacturing Company

162 **Variable-speed pulleys** designed to eliminate freezing and sticking are covered in 12-p catalog 4101. Gives technical data for five sheaves, 2 to 15 hp. T B Wood's Sons Company

163 **Takeup units** are featured in 16-p bearing catalog BU-101-B. Pillow blocks, flange blocks, ball bearings are covered. Browning Manufacturing Company

164 **Flexible couplings** in four sizes, 1¼- to 2¾-in. maximum bore, are covered in 2-p spec sheet 67. Ajax Flexible Coupling Co

165 **Flexible shafting** for high-speed power drives is subject of bulletin 590. Stow Manufacturing Co

PUMPS

166 **Fire and booster pumps** are described in 10-p bulletin 08 B 9032 and 4-p 08 B 8551. Centrifugal double-suction single-stage units are approved for heads from 50 to 145 psi, capacities from 500 to 2500 gpm. Allis-Chalmers Manufacturing Co

167 **Proportioning feeder** is topic of 4-p bulletin 1140.20A-1. Cutaways show fluid-end construction. B-I-F Industries, Inc

168 **Reactor-system pumps** to operate at high pressures and temperatures are subject of bulletin PR-2. Units for atomic-powered steam-generating plants, research reactors, test facilities are covered. Food Machinery and Chemical Corporation, Peerless Pump Div

169 **In-line submersible pumps** for booster service are topic of bulletin 203. Layne & Bowler, Inc

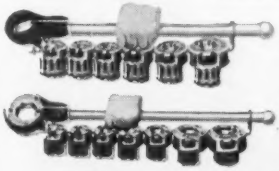
continued

To save time . . .
Every Tool Box Needs
a compact, easy-to-carry
RIDGID®
Drop Head Threader Set

Snap a die head in the ratchet ring . . . cut your thread! It's as simple as that with a RIDGID drop head threader. Heads can't fall out . . . dies reverse quickly for close-to-wall threading. Finest quality RIDGID long wearing dies. Bolt and conduit dies available.

Call Your Supply House!

Hand Carrier Free With All Sets Except No. 12-R
(Order in sets or any combination)



Exposed Ratchet Type
For pipe: ⅛" to 1"—00-R; ⅛" to 1¼"—111-R; ⅛" to 2"—12-R
For bolts: ¼" to 1"—00-RB

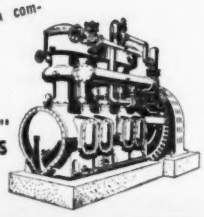
Enclosed Ratchet Type
For pipe: ⅛" to 1"—0-R; ⅛" to 1¼"—11-R

RIDGID
The Ridge Tool Company, Elyria, Ohio, U.S.A.

For more facts circle 255 on Reader Service card, p 97

Making dry ice at 109° below zero using standard ammonia compressors in an improved cycle.

"HEAVY DUTY" COMPRESSORS



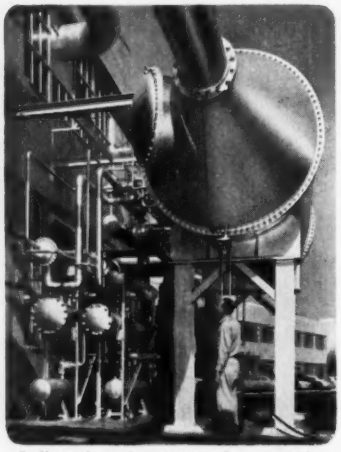
FRICK

ENGINEERS

WILL DESIGN . . . BUILD *and* INSTALL FRICK SYSTEMS . . .

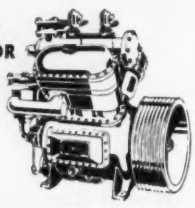
to solve your most difficult cooling problems.

If you need any type of industrial or commercial cooling—for quick freezing, cold storage, ice making, humidity control, low temperatures, condensing, air conditioning, or any process work—contact the nearest Frick Branch or Distributor for recommendations and estimates.



Cooling air under pressure for supersonic speed tests.

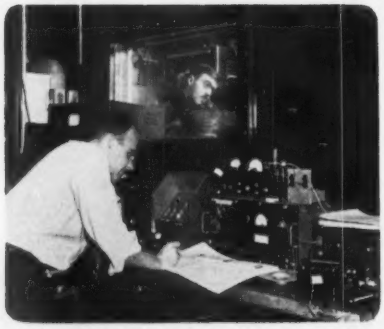
"ECLIPSE" COMPRESSOR



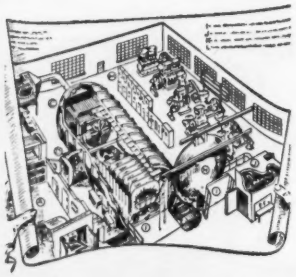
DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA., U. S. A.



Test laboratory work for temperatures down to 140° below zero.



All-weather Laboratory built for U. S. Army. Uses 3-Stage compressors, mantains Arctic, tropic and stratospheric conditiitions.

Free literature

Begins on page 98

170 **Proportioning** at low pressure and atmospheric discharge is discussed in 4-p reprint RP-1106-2. B-I-F Industries, Inc

171 **Pump-recirculation** control system to maintain safe, adequate flow is discussed in 2-p bulletin 560. Bailey Meter Company

SAFETY EQUIPMENT

172 **Fire-extinguishing systems,** portable extinguishers, cabinets and other inside fire-control products are detailed in 28-p brochure S-62. Specs, operation descriptions, installation diagrams, component cutaways and dimensional drawings included. The Fyr-Fyter Company

173 **Portable fire extinguishers** and accessories for plant and office use are listed in new brochure. American LaFrance Corporation

174 **Safety hats** and caps available in colors for personnel identification are described in 4-p bulletin 0601-4. Mine Safety Appliances Company

STEAM GENERATION

175 **Induced-draft fans** help improve fuel efficiency, according to 4-p bulletin L-1A. Schematics, dimensional diagrams are included. Fuller Company, Lehigh Fan & Blower Div

176 **Low-cost flyash handling** methods using pneumatic conveyors are studied in 16-p bulletin FF-49-1. Fuller Company

177 **Combustion-control system** application to four makes of pulverized-coal fired boilers is described in 12-p bulletin 510. Bailey Meter Company

178 **Shot-cleaning system** for removing soot and ash deposits is topic of 4-p bulletin 2145. Diamond Power Specialty Corporation

179 **Boiler-wall coating** is topic of 2-p data sheet M-2-A. Benjamin Foster Company

180 **Coal conveyors,** *Type C,* are described in 2-p data sheet. The Daniels Company

181 **Horizontal rotary burners,** model *BHE,* are topic of 4-p bulletin 415. Includes table of capacities and specs. Preferred Utilities Manufacturing Corporation

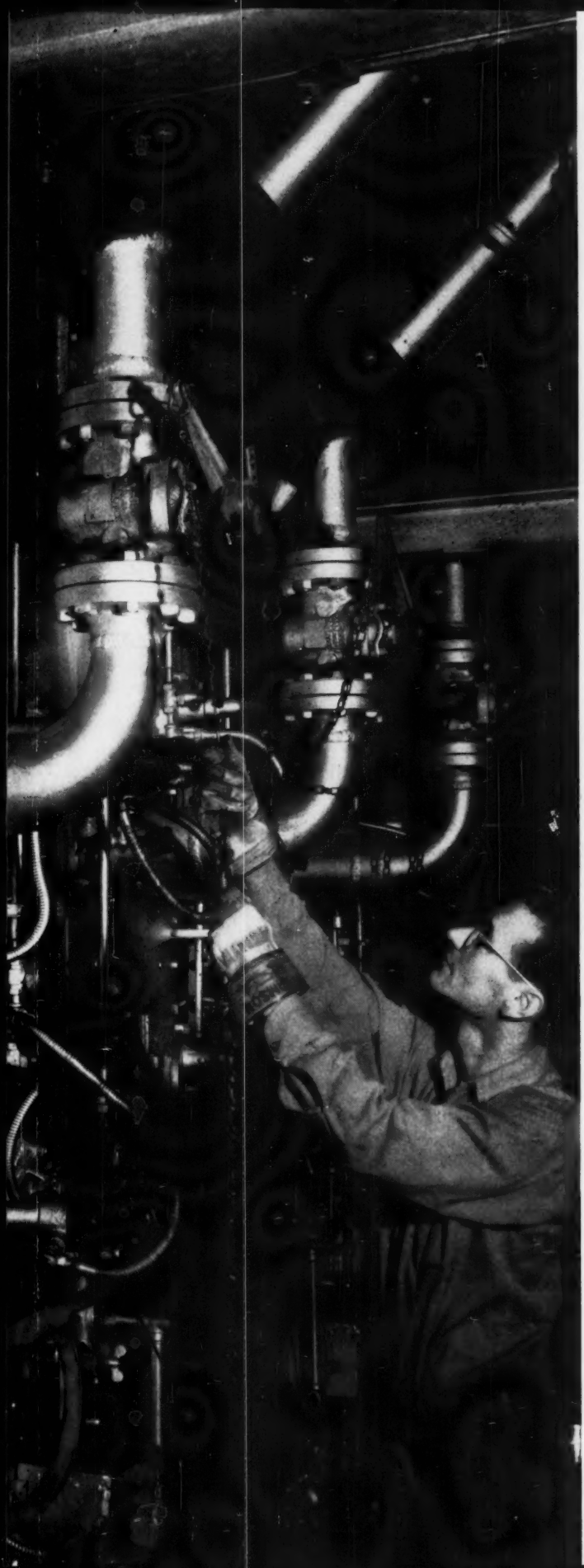
182 **Rotary burners,** model *B,* are discussed in 2-p data sheet 405. Preferred Utilities Manufacturing Corporation

VALVES, PIPING, FITTINGS AND SPECIALTIES

183 **Cast-steel valves** — gate, globe, angle, swing check—are covered

For more facts circle 256 on Reader Service card, p 97

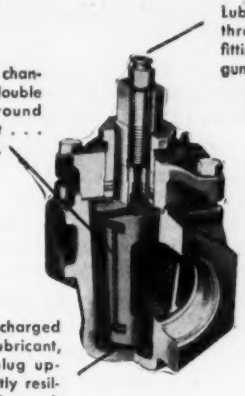
circle 257 on Reader Service card, p 97 ➤



POSITIVE SHUT-OFF ON GAS FUEL LINES?

Most valves can't really hold gas. Rockwell-Nordstrom lubricated plug valves can, and *do* for many power engineers who insist on them where leakage can't be tolerated on gas fuel lines. In the cut-away valve picture below, you'll see heavy red lines on the plug . . . they're the Sealdport® grooves that are charged with *pressurized lubricant* to maintain a double, impenetrable seal against leakage. This lubricant sealing system gives you a tighter seal on gas lines without any of the problems of ordinary metal-to-metal seats. Lubricant sealing can't be scratched, cut or corroded. And you'll save operating dollars by eliminating frequent, costly reseating.

The cutaway valve also illustrates some other important benefits you can expect *only* from lubricated plug valves. Notice the film of lubricant that makes the quarter turn operation smooth and easy; prevents flow control errors. And lubrication *prevents wear*, another reason why these valves stay in service longer, cost less to use than ordinary valves.


Lubricant injected through Rockwell fitting by pressure gun.
Lubricant through channels in plug forms double pressure seal around each valve port . . . *leakage eliminated.*
Lubricant chamber, charged with pressurized lubricant, counterbalances plug upwards against slightly resilient shoulder seal. Plug can't be stuck in seat . . . *instant, dependable operation.*

Rockwell-Nordstrom valves, the world's most complete line of lubricated plug valves, cost no more to buy—often less—than ordinary valves. You can get complete details or have a Rockwell Field Engineer visit you by writing: Rockwell Manufacturing Company, Pittsburgh 8, Pa. Canadian Valve Licensee: Peacock Brothers Limited.

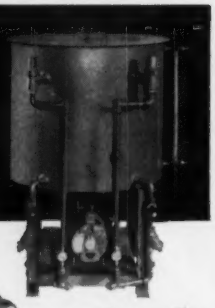
ROCKWELL-Nordstrom VALVES

another fine product by

ROCKWELL

Figure 143 Rockwell-Nordstrom lubricated plug valves on gas fuel boiler manifold at large eastern power station.

for accurately metered water treatment



Available with standard feeder tanks of various sizes

specify

AMERICAN CHEMICAL FEED PUMPS

Want *low initial cost, design simplicity, accurate control* and *minimum maintenance cost?* Get them all with American Series 100 controlled capacity pumps!

Series 100 pumps move specific volumes of fluid with a repetitive metering accuracy of ± 1%, when operating between the limits of 10% to 100% of stroke length. A screw adjustment on the crank provides easy, accurate stroke regulation for capacities ranging from .65 gph to 13.10 gph at a maximum pressure of 1000 psi on Series 100 Simple model. Duplex models have double that capacity.

- Spherical self-aligning bearings on crank and crosshead handle greater radial and axial thrust loads
- Nylon dust covers keep dust and dirt from bearing surfaces
- Crossheads of hardened and ground steel ride on cast iron
- Easily adjusted screwed packing glands
- Interchangeable liquid ends
- Heavy duty reducers
- NEMA frame motors

These quality features make American controlled capacity proportioning pumps the most dependable, economical answer to your water treatment needs.

AMERICAN® METER COMPANY
INCORPORATED ESTABLISHED 1836
pump division
13500 PHILMONT AVE., PHILADELPHIA 16, PENN.

Free literature

Begins on page 98

in 20-p booklet KS-1. Includes photos, dimensions, ratings. Kerotest Manufacturing Company

184 **Pressure-reducing valve** for steam, water, oil, gas, air, chemicals is topic of 6-p folder J-160. Jordan Corporation

185 **High-velocity air valve** operating without motors or linkage mechanism is discussed in 2-p bulletin. Connor Engineering Corp

186 **Sliding-gate** diaphragm motor valve is topic of 4-p folder J-170. Jordan Corporation

187 **Equalizing valve** for metering burner oil is described in 2-p data sheet 420. Preferred Utilities Manufacturing Corporation

188 **Pressure-regulator pilot** for steam, air, gases and liquids is subject of 2-p catalog sheet. Atlas Valve Company

189 **Tubings,** extruded and coated, are detailed in 24-p manual 59T. Complete specs are given, plus footage requirements for cut pieces. William Brand & Co, Incorporated.

190 **Flexible rubber pipe** for corrosive, abrasive service is featured in brochure 7152. Raybestos-Manhattan, Inc, Manhattan Rubber Div

191 **Insulation** for gas lines and vessels is discussed in 6-p bulletin 5M-P-1-59. Baldwin-Hill Co, Insidline Div

192 **Forged-steel unions** are detailed in 8-p catalog U-2-58. Types, sizes, materials, pressure ratings are described for the complete line. H K Porter Company, Inc, Forge and Fittings Div

193 **Stainless-steel strainers** for pipe sizes from ½ to 2 in. are covered in spec sheet SS-143. Strong, Carlisle & Hammond

194 **O-ring seal** tube fittings, flare and pipe fittings are featured in new hydraulic, pneumatic and vacuum catalog. Lenz Company

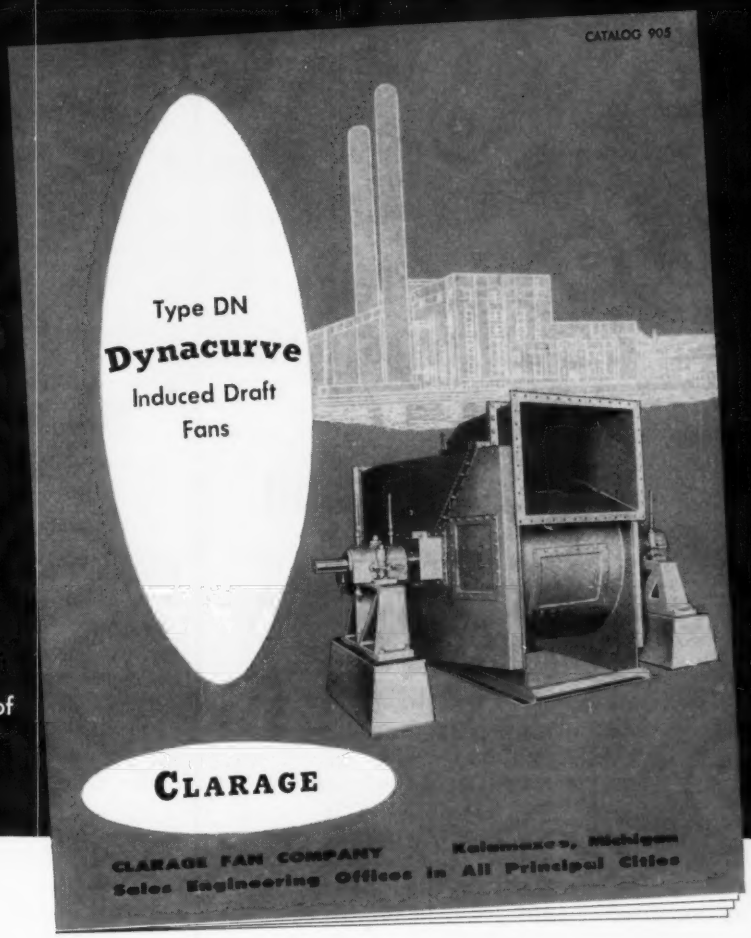
195 **Humped aluminum elbow** for piping is described in 2-p data sheet. General Aluminum Supply Corporation

196 **Expansion joints,** rubber, neoprene and Teflon lined, and flexible couplings are detailed in bulletin AD-137. The Garlock Packing Company

197 **Pipe plugs** are topic of 2-p data sheet. Units have improved thread form. Lock Thread Corp

198 **Metal gaskets,** spiral-wound units, are described in bulletin

CLARAGE



Low cost
Low tip speed
Low moment of inertia (WR^2)

High efficiency
High dynamic conversion
High standards of construction

Learn more about the stand-out fan in the induced draft field

Request Catalog 905 or contact the nearest Clarage sales engineering office.

Dependable equipment for making air your servant

CLARAGE FAN COMPANY

Kalamazoo, Michigan

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

"GOOD FROM THE FIRST DROP"

..Steam Traps ready to go again with a B-J Cage Unit

The moment you drop a B-J cage unit replacement into a faulty steam trap — it's good again . . . renewed and ready to go to work. Now there's no reason for prolonged shut-down while you repair imperfect traps. You simply:

- **REMOVE** the cap right on the line
- **REPLACE** the interior with a B-J cage unit
- **RECAP** the trap assembly
- **RENEWED** . . . all new and ready to go

It's as easy as replacing a light bulb and the cage unit element is always where it belongs for rapid response to trap conditions. For in this modern unit, a quick-action, completely accurate bellows is combined with a perfect-fit plug and seat, then enclosed in a sealed monel cage. And there may be no need to dispense with your present steam trap investment. B-J industrial cage units can probably be installed in your present thermostatic traps or used in a complete B-J system.

For the complete story on steam trap functions and maintenance — write today for "The Steam Trap Primer". You'll see the 'hows' and 'whys' of steam trap performances. And perhaps you'll see how B-J cage units can end your steam trap problems.

"Be Wise . . . Be Sure . . . B-J"

BARNES & JONES, INC.
36 Crafts St. • Newtonville 60, Massachusetts

Free literature

Begins on page 98

AD-104. The Garlock Packing Company

199 **Expansion-joint** selection is covered in 4-p bulletin. Application data is given to aid selection. Zallea Brothers

200 **Flow-check snubber** isolates instrument from pressure-transmitting medium — 2-p bulletin gives details. Chemiquip Co

★ EDITOR'S NOTE: *The following bulletins may be requested directly from manufacturer. Write on company letterhead to addresses below*

★ **Mechanical - draft** and other heavy-duty fans are described in 28-p bulletin FD-905. Selection data, performance tables, design sketches included. Buffalo Forge Company, Buffalo 5, N. Y.

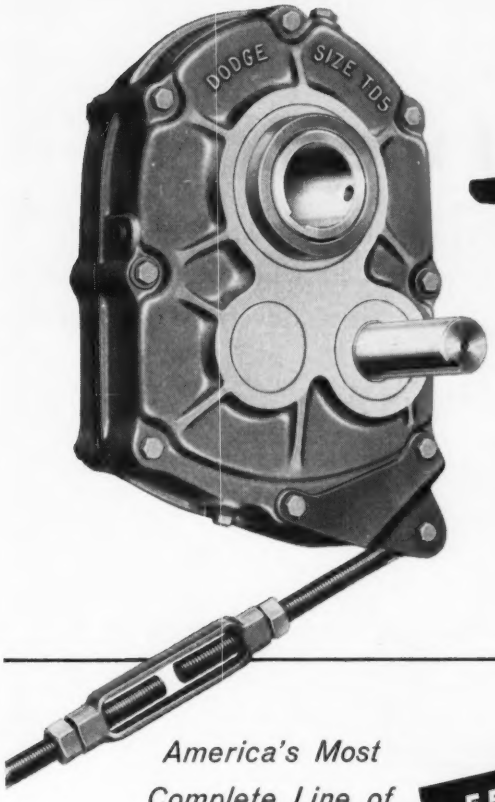
★ **Carbon,** graphite properties and uses are covered in 56-p manual. Application info for mechanical, electrical, refractory uses is given. Stackpole Carbon Company, St. Mary's, Pa.

Korea and Red China will build a water power plant at the Yalu River between N Korea and Manchuria.

Rhodesia Congo Border Power Corp has announced plans for building a $1,680,000 electricity substation to supply Northern Rhodesian copper mines.

Ratings to 800,000 kva for generators are predicted within ten years by the AIEE, if trend continues.

"They turned down your requisition for the valve but you got the light bulb you wanted."



Torque-Arm

THE DODGE DEVELOPMENT THAT CHANGED THE NATION'S HABITS OF SPEED REDUCTION

America's Most Complete Line of Shaft Mounted Speed Reducers

55 MODELS

- 1 to 200 hp. at 100 rpm!
- Output speeds from 10 to 378 rpm!
- Single Reduction
- Double Reduction
- 5 to 1 Ratio
- 15 to 1 Ratio
- 25 to 1 Ratio
- Any speed ratio up to 150 to 1 obtainable by selection of pre-determined combination of reducer and V-belt drive.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look in the *white* pages of your telephone directory for "Dodge Transmissioneer."

In fewer than ten years, the range of Torque-Arm Shaft Mounted Speed Reducers has increased from 6 to 55 models, to meet the ever increasing demand for this improved method of speed reduction.

By eliminating foundation, sliding base and flexible coupling this modern speed reducer has saved untold installation time and untold dollars of cost.

The rugged semisteel housing developed by Dodge has never been improved upon. It is corrosion resistant—and it has the strength to hold bearing seats in line for the life of the unit.

Dodge design provides wide spacing for the bearings. Loads are carried easily, contributing to Torque-Arm's long life and very high efficiency. The gears are finest quality—helical, heat treated steel.

Torque-Arm mounts vertically or horizontally in any position around the driven shaft. It locks to the shaft on *both* sides of the housing. The holes in the output hub provide simple removal with puller. Overload release and built-in backstop are optional.

Dodge Torque-Arm is America's most widely used shaft mounted speed reducer. It is stocked by your local Dodge Distributor. Ask him. Or write us for bulletin.

DODGE MANUFACTURING CORPORATION, 3200 Union, Mishawaka, Ind.

DODGE
of Mishawaka, Ind.

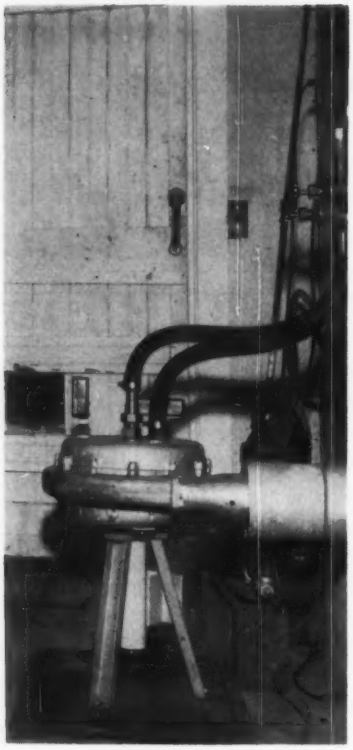
For more facts circle 261 on Reader Service card, p 97

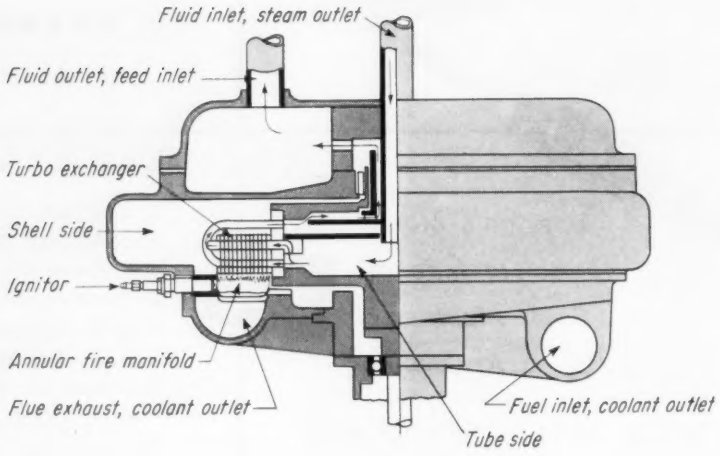
EXCLUSIVE

Equipment design of the month

On this page each month you will see the wraps taken off a significant new product at least 30 days before it's released to any other publication, and before it's advertised anywhere

By STEVE ELONKA
Associate Editor





Novel centrifugal-action steam generator bows in

Revolutionary new concept in steam generation uses centrifugal action and high velocity to speed transfer.

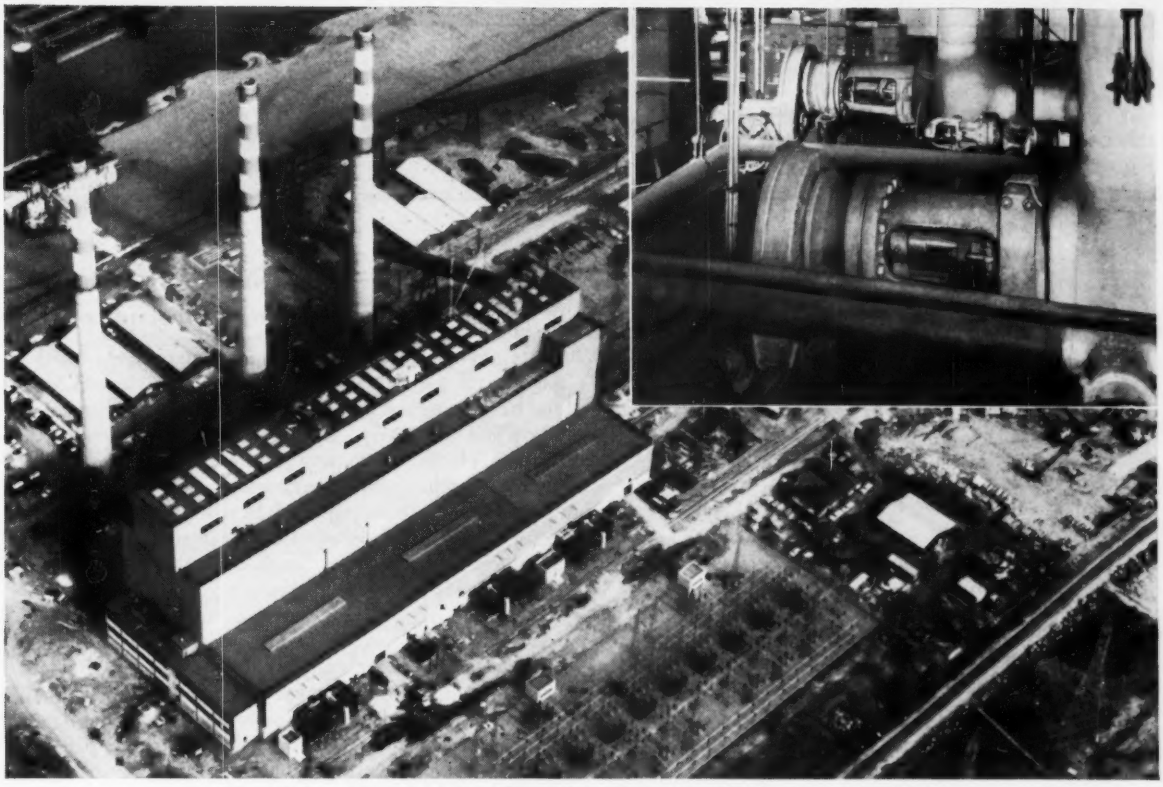
Developed by Beltran Associates, Inc, Brooklyn, N. Y., the *Turb-O-Heat* has a tubular heat exchanger arranged in the form of a disk rotating at several thousand rpm. This exerts a strong suction on pre-mixed gas and air entering the annular burner through fuel inlet. Passing through ports of annular burner plate, fuel is ignited and burns in combustion chamber. Due to fanlike action of turbo-exchanger, hot products of combustion pass through spaces between tube fins, giving off heat to fin and tube surfaces. High relative velocity between gases gives high heat transfer. Cooled gases are exhausted through a spiral-shaped flue.

On tube side, fluid to be heated enters revolving turbo-exchanger. Vanes on inside of revolving body fling the liquid entering at center of rotation outward. Liquid flows around U-bend of tubes, returning towards center of rotation on outlet side of partition. There it is intercepted by the hydrostatic pickup which pumps it into annular chamber of housing and out into system.

This unit can handle fluids for heating, cooling, vaporization and condensation. Generator packs a lot of power into less than two cubic feet of space; produces 300,000 Btu per hour. Weight is 150 lb. A conventional steam generator of same capacity weighs one ton, takes up six times more volumetric space.

Here are some of the generator's outstanding features: (1) instantaneous action means unit can deliver 100-psi steam in as little as 20 seconds (2) compact power, 300,000 Btu per hour (3) unit is lightweight, portable, can be wall-mounted, suspended or directly attached to process apparatus (4) unit is adaptable either as a heat exchanger or a condenser as illustration shows.

For additional information, circle No. 94 on Reader Service card, page 97



Thomas H. Allen Generating Station—Memphis Light, Gas & Water Division—City of Memphis, Tenn.
Burns & Roe, Consulting Engineers. Generating Capacity: 862,500 kw. Insert shows some of the 8000 Crane valves installed in plant.

Crane builds giant pressure-seal bonnet valves for giant Memphis power plant

The Thomas H. Allen Electric Generating Station, pride of Memphis, Tenn., is the largest municipal power plant ever authorized at one time. This huge, 121-million-dollar project, in full operation, has an output capacity of 862,500 kw.

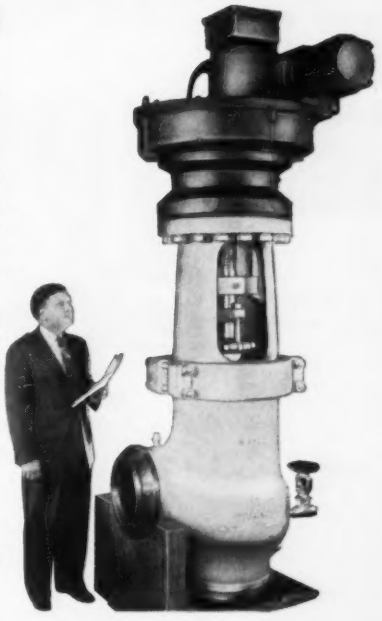
Piping plans for this immense plant called for 24 16-inch, motor-operated high-pressure/temperature angle valves—*largest valves of this type ever to be made.* They were for service on the inlet and outlet ends of 12 high-pressure, multiple-pass feed-water heaters.

Crane built all 24 valves—in pressure-seal bonnet design. These valves can handle a flow of two million pounds per hour at 585° F. and are designed for tight shutoff at 2840 psi under the disc. Special motor-operators had to be developed to provide the 500,000-pound thrust required for closing.

8000 valves—mostly Crane

In addition to supplying these 24 specially made angle valves, Crane also furnished most of the approximately 8000 other valves used on the job—carbon steel, alloy steel, iron and bronze.

Who but Crane has the modern facilities—in metallurgy, casting, inspecting, testing and other manufacturing procedures—for producing quality valves in *any* size, to *any* specifications, in *any* quantity on *schedule!* For details, consult your Crane Representative.



One of the 24 16-inch, motor-operated pressure-seal bonnet angle valves made specially by Crane. Stands 11 feet high . . . weighs 11,000 pounds.

CRANE® VALVES & FITTINGS

PIPE • PLUMBING • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill.—Branches and Wholesalers Serving All Areas

In Canada: Crane, Limited, 1170 Beaver Hall Square, Montreal, Que.

For more facts circle 262 on Reader Service card, p 97

Plant equipment news . . . Your

Packaged electric clutch and sheave fit all motors

1 • Direct installation on all standard NEMA electric motor shafts is possible with *Electro-Sheave.* Five sizes, rated from 1 to 25 hp, can be applied to new equipment or used for updating existing plant equipment.

Packaged units feature no-load starting. They will engage or release at any speed—for inching or jogging several starts can be made in less than one revolution of the clutch. Release is instantaneous; load is braked without plugging the motor.

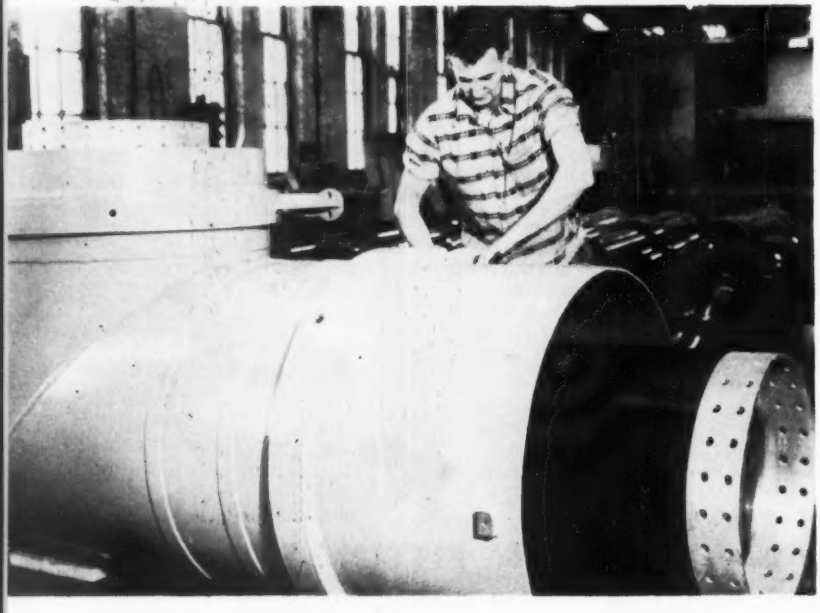
Clutch and sheave are factory-aligned and -assembled. Clutch, ball-bearing sheave and shaft-extension sleeve fit as a package. Actuation of clutch field attracts and locks armature, which picks up motor rotation, transmits it to pulley. When clutch is disengaged, sheave runs freely on rolling-contact bearings.

There is no mechanical connection between motor shaft and sheave, so no torque can be transmitted. On installations where motor is started and stopped often, elimination of high motor-starting currents means smaller starters can be used.—Warner Electric Brake & Clutch Co

Switchboard interchanges distribution, control units

2 • Flexibility, compactness and versatility are advantages claimed for a new line of shallow-depth distribution switchboards. The centralized equipment was developed for medium-sized commercial and industrial buildings. Interchangeable distribution and control units of modular construction can be utilized with the switchboards.

Units are only 14-in. deep. They can be fitted with Type AB circuit breakers, fusible switches, magnetic and manual motor starters. Three classes of incoming and distribution units are available, one with panelboard section, one with main disconnect section and a space for utility metering, one with panelboard section and space for utility metering. Switchboards are rated up to 600 v ac, 250 v dc. Bus ratings are 200 to 1200 amp vertical, up to 2000 amp horizontal.—Federal Pacific Electric Co



Isolated phase bus rated 12,000 amp is now available

3 • Boasting a current-carrying capacity of 12,000 amp, the highest ever produced by company, bus is made up of a 20½-in. round aluminum conductor in a 35-in. nonmagnetic aluminum housing.

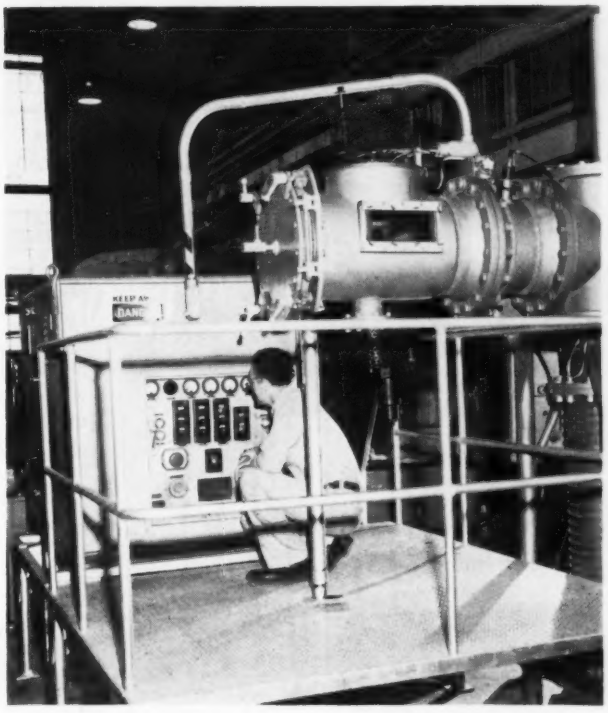
In first installation, bus will see service as a station generator-to-transformer connection. Tests indicate that this bus design can carry even higher current with no major heating difficulties. Cover and conductor stayed within the 30- and 50-C temperature rise allowed by the ASA, according to the manufacturer.—I-T-E Circuit Breaker Company

information center for new products and materials

Electron-beam welder joins reactive metals

4 • Reactive and high-melting-point metals used extensively for atomic reactors and missiles are successfully joined by new process. High-intensity beam bombards materials to be welded in high-vacuum chamber. Vacuum eliminates danger of contamination by atmosphere during welding and does double duty by removing many contaminants present in the original work pieces.

Beryllium, molybdenum, tantalum, zirconium and hafnium are some of the exotic metals that can be welded by this process. Size of electron beam, as small as 1/16 in. dia, can be controlled with great accuracy. Resultant welds are stronger, more ductile and have improved contour, according to the manufacturer. Application of the electron-beam vacuum-welding process requires equipment that is custom built for specific jobs.—Air Reduction Company, Inc



Polyurethane features high tensile strength

5 • High tensile strength at high ultimate elongation is property of *Estane VC*, a new thermoplastic elastomer. Excellent solvent resistance, particularly to gasoline; low air permeability and outstanding abrasion resistance are other advantages claimed for the material.

The polyurethane plastic snaps back like rubber, but needs no time-consuming vulcanizing. Tensile strength is 7000 to 8000 psi, and extensibility is 550%.

First major application is expected in wire and cable jacketing, with other potential uses including fuel hose, tubing, belting, valve diaphragms, pump components, insulators.—B F Goodrich Chemical Co

Lightweight Geiger counter is inexpensive, reliable

6 • System built around only two Geiger tubes weighs 400 lb, is priced within budget of average labs. High price and weight of conventional systems come from elaborate shielding and guard tubes needed to reduce background count. In new system, one cosmic-ray guard tube does all shielding duty, reducing background count to one discharge per minute. Beta-detector tube fits right into the cup-shaped anode of the guard tube.

System is suitable for radiation measurement in labs and nuclear installations. It is also handy for field work—engine wear studies, waste-material testing, monitoring atomic reactors.—Amperex Electronic Corporation, Special Tube Div

Electrical-resistance probe measures contaminants

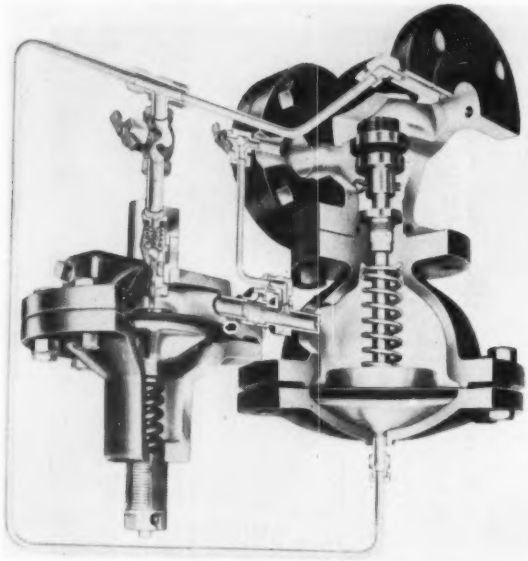
7 • Environmental changes are detected with extreme sensitivity by this probe. Unit actually measures corrosion, but its main practical application will be in measuring hard-to-detect liquid and gaseous contaminants. Slightest change in water content of nonaqueous liquid or any other metal-attacking condition is picked up.

Film of metal 2 to 50 millionths of an inch thick is vacuum-deposited on probe; part is protected as a control. As probe is exposed to medium under test metal coating is corroded, resistance ratio of exposed to protected areas increases, attached instrument detects metal loss in billionths of an inch.—Magna Products, Inc, Crest Instrument Company Div

For more data on these developments, circle key numbers on Reader Service card, p 97

More **equipment news**

For more data on these developments, circle key numbers on Reader Service card, p 97



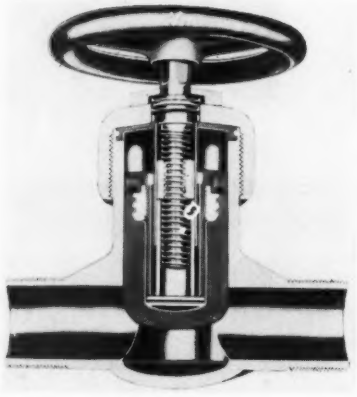
Step reductions from 600 to 1 psi given by pilot-operated valve

8 • Universal pressure-reducing valve controls either compressible or incompressible fluids without design change. *Class AD* valve takes steam, water, gas, oil, air in stride. Precise pressures between 0 and 125 psig are obtained by interchanging three springs, without removing valve from service.

Single-seated unit gives full port opening, positive dead-end closing or any degree of modulation needed for precise downstream pressure control or continuous demand. Valves through three inches provide full effective port opening, according to maker, with slightly less opening on larger sizes. All piping connections are fabricated within flanges of main valve, so unit comes ready to bolt in place and put into service. Fully guided stems mean pilot or main valve can be installed in any position. Unit has Teflon guide and nonmagnetic internals to guard against stem bind. It is self-contained and packless, readily accessible for inspection. The C E Squires Company

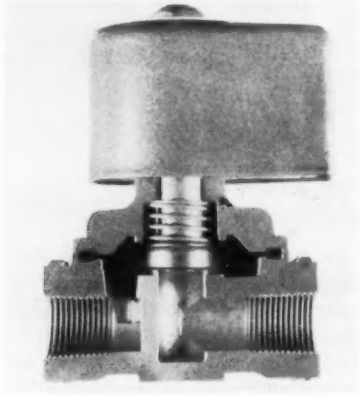
Valve jacketing handles heat-transfer problems

9 • Sliding-gate regulators now come with *Thermon* jacketing to solve industrial heat-transfer problems with viscose or hard-to-handle fluids. Nonmetallic jacketing is said to be efficient and inexpensive, working equally well for heating or cooling. Suitable for pressures to 250 psi, temperatures to 406 F, it is easily removed for access to the valve. Jacketed regulators are available in size range from ¼- to 6-in.—OPW-Jordan



All-plastic valve features dependable sealing

10 • In a telescopic arrangement, soft rubber cup is forced to the concave bottom of valve's passage. Under pressure from stem, flexible cup seals on all sides against walls of body casing, positively shutting off fluid flow. Foreign matter is accommodated without damage to valve or loss of sealing. Installed on metal or plastic piping systems, 1- to 4-in. units are rated for 145-psi working pressure.—W S Rockwell Company

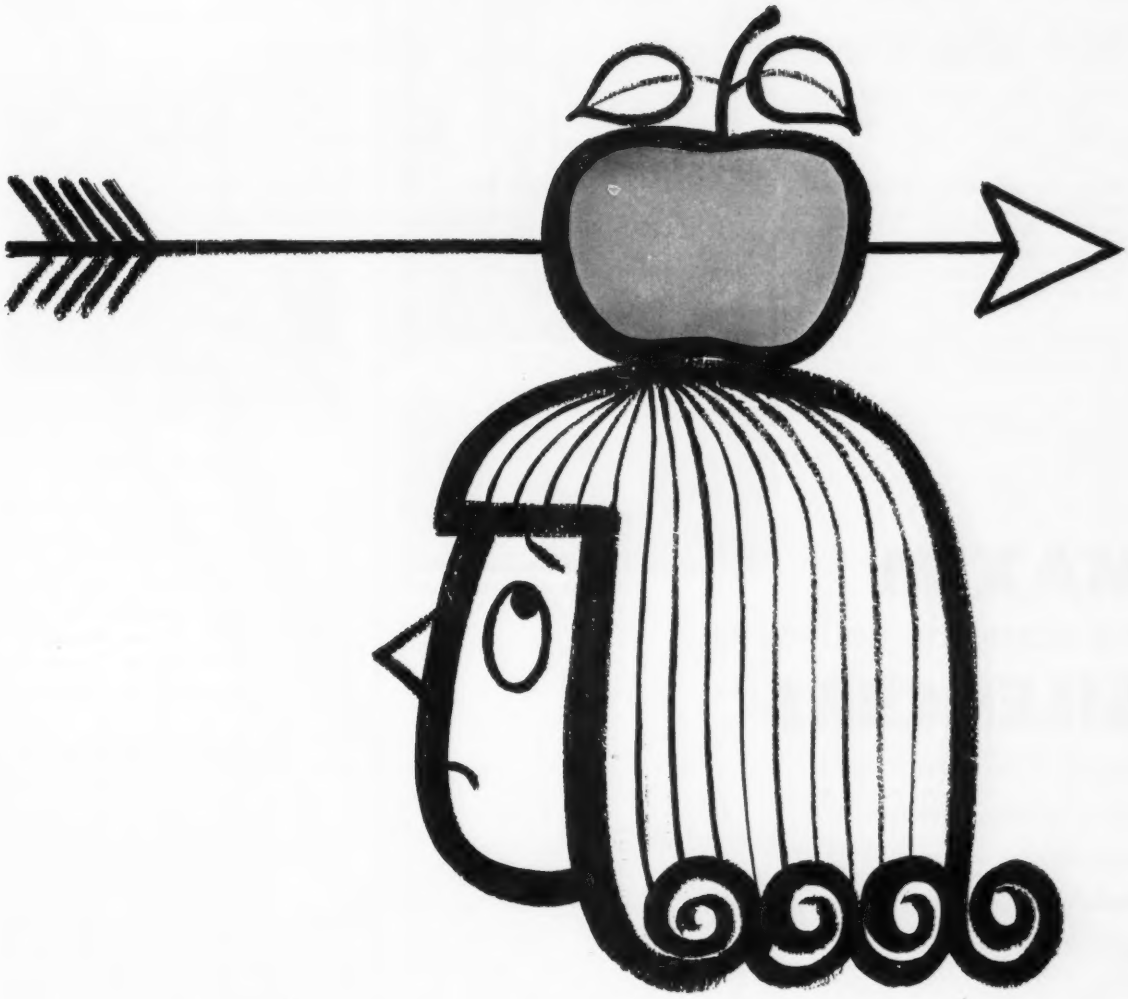


Direct-lift solenoid valve has one moving part

11 • This 2-way solenoid valve will handle steam, air, gas, light oil, water and other noncorrosive liquids and gases, for industrial heating control, vacuum and general service at mainline pressures up to 40 psi. Valve has a forged-brass body and bonnet, stainless-steel core and spring and *Buna N* disk. For steam service, a Class H insulated coil, natural rubber disk and O-rings are used.—Automatic Switch Company

continued

For more data on these developments, circle key numbers on Reader Service card, p 97



It pays to rely on a specialist...

Even good oils and greases can miss the mark without the skill and experience that come with a Mobil Program of Correct Lubrication

More and more manufacturers are discovering what lubrication can do . . . *in the hands of a specialist!*

And there's only *one* lubrication specialist with so much background experience protecting and serving industry . . . Mobil!

With a Mobil Program of *Correct Lubrication* you get far more than just oils and greases. You get the services of a Mobil lubrication engineer who works closely with your plant engineer. He will set up a lubrication timetable for every machine in your shop. He'll make cost-cutting lubrication maintenance recommendations . . . provide laboratory service when needed . . . even initiate in-plant training courses for your plant personnel.

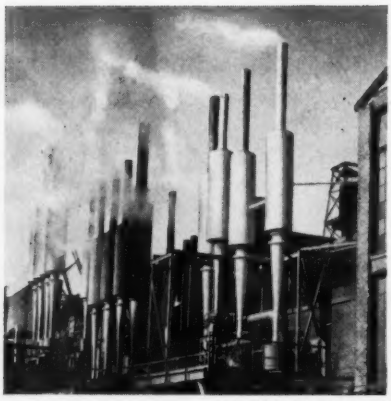
These services are just a part of this comprehensive program. Together they can sharply reduce manufacturing costs, improve production.

Why rely on "hit or miss" lubrication when you can call on a specialist who can draw on over 93 years of experience. Make it Mobil Correct Lubrication . . . the *profitable* way to protect your plant.

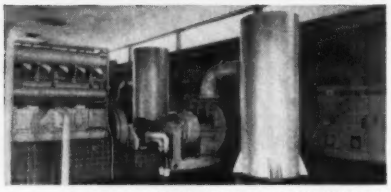
Mobil **Correct Lubrication**

Another reason you're Miles Ahead with Mobil

For more facts circle 263 on Reader Service card, p 97



STEAM AIR EJECTORS



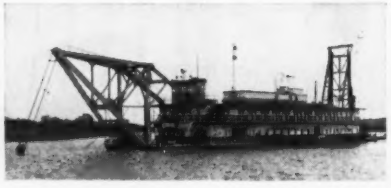
SEWAGE PLANT COMPRESSORS

MAXIM

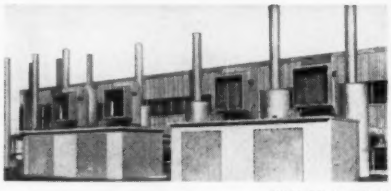
THE COMPLETE SOURCE OF

SILENCERS

For over 50 years, Maxim's main concern has been to engineer the finest silencing equipment possible. Maxim's complete line of silencers makes it possible to select precisely the kind and degree of noise control you need. Put Maxim engineers to work on your special problems, or send for latest bulletins.



MARINE ENGINES



POWER PLANTS

Emhart Manufacturing Company
Maxim Division
Hartford 1, Connecticut

EMHART

Emhart Manufacturing Company, Maxim Division 60
Hartford 1, Connecticut

Please send me bulletins on Maxim Silencers for:

- ☐ Waste heat recovery
- ☐ Steam, air or gas discharges
- ☐ Jet engine exhaust and intake
- ☐ Internal combustion exhaust and intake
- ☐ Air compressor intakes and discharges
- ☐ Blower intakes and discharges

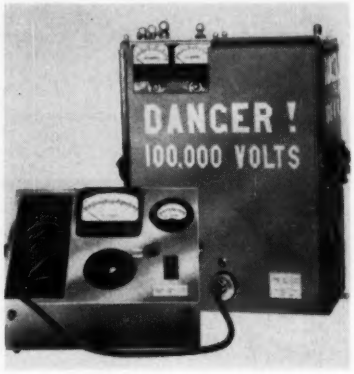
name

company

address

Equipment news

Begins on page 112



Dc instruments

31 • Portable, lightweight h-v dc insulation-test instruments and power supplies are now available in 30-kv, 40-ma through 250-kv, 7-ma ranges. All units are sectionalized for maximum portability. Shown, above, is the 100-kv, 5-ma dc test set. Power unit weighs 58 lb, control unit weighs 27 lb. Unit can be extended in 50-kv stages to 250 kv.—The Hewson Company, Inc

Just circle key numbers on the Reader Service card, page 97, to get complete product story

Fibrous silicone rubber

35 • This form of silicone rubber is fibrous, with properties resembling sponge and foam. A mat of random silicone-rubber fibers, *Cohrlastic FSR* has tensile and tear strength superior to silicone sponge and foam, according to maker.

Features include high permeability, good tear resistance, good tensile strength. Usable temperature range is −65 to +500 F.—Connecticut Hard Rubber Co

Steam-atomizing burner

16 • Steam atomization is now adapted to packaged firetube boilers, making it practical to burn low-cost heavy oils—bunker C and No. 6. Sys-

IN SRE... Zallea expansion joints absorb thermal expansion of reactor core tank and outer tank

The very nature of the Sodium Reactor Experiment, conducted by Atomics International for the AEC, and the method of handling the liquid sodium reactor coolant demand reliability in expansion joints. Because of the operation there can be no compromise in design or quality.

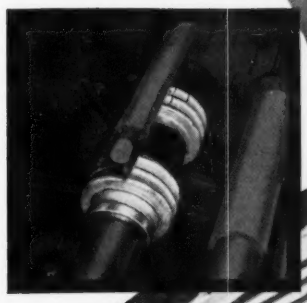
The high temperature SRE uses Zallea Expansion Joints where thermal expansion must be absorbed and where a gas seal must be maintained. An 11-ft. diameter Zallea Expansion Joint at the top of the outer tank absorbs the expansion that results from the temperature increase in these components as the reactor comes up to operating temperature, 960°F. In addition, the expansion joints form a seal for the helium gas and sodium vapor above the sodium pool at the top of the reactor as well as for the helium gas within the outer tank.

In the sodium coolant piping circuit gas seals are effected by means of Zallea Expansion Joints in the region where the pipes leave the reactor cavity and enter the pipe galleries.

Zallea has worked with almost every major engineering and manufacturing firm engaged in atomic, nuclear and missile work—and has provided the large majority of expansion joints for such projects. As a result, we have accumulated a store of expansion joint engineering data and manufacturing skills that cannot be equalled. Whenever expansion is involved in piping systems, reactors, tanks—whatever the application—let our engineers work with you. We already have the answer to many of the difficulties you will encounter. And we welcome the chance of tackling your problem.

Zallea
expansion joints

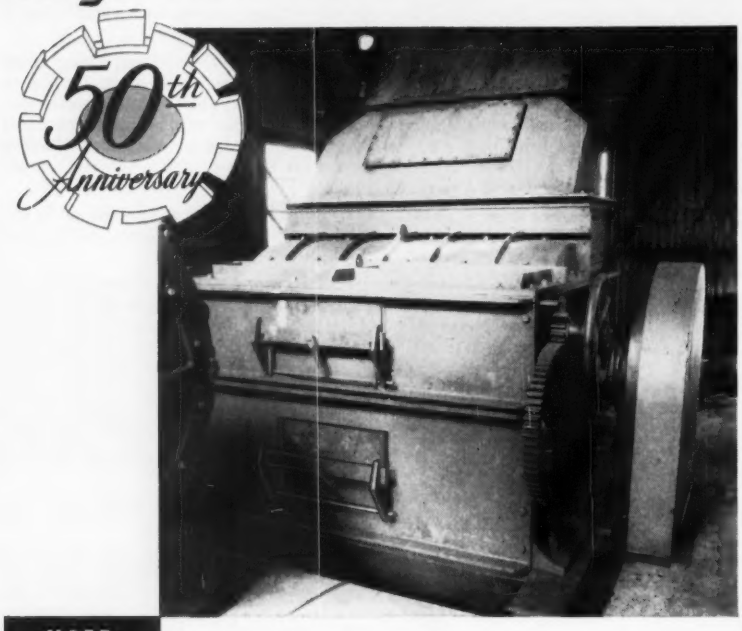
ZALLEA BROTHERS, Wilmington 99, Del. • World's largest manufacturer of expansion joints



For more facts circle 265 on Reader Service card, p 97

CRUSHING FACTS

from American PULVERIZER CO.



USER REPORTS

"We've reduced 2,521,000 tons of 2" N & S coal to a ¾" product. Crusher has given satisfactory service. Rings and screens have been renewed only once."

Replacement parts on this American AC-7C Rolling Ring Crusher after crushing 2½ million tons of coal have cost only $0.0016 per ton (1/6th of a cent).

There's good reason for performance records like this. The American originated rolling shredder ring efficiently splits coal instead of crushing it. Coal spends less time in the crusher; therefore, there is less attrition in the crushing chamber and less wear on the screens. Further, the rings are reversible for double wear. In addition, the effectiveness of the crushing elements permit slower operation speeds.

Our engineers will analyze your reduction problem. No obligation to you.

American PULVERIZER COMPANY
ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS
1349 MACKLIND AVE. ST. LOUIS 10, MO.

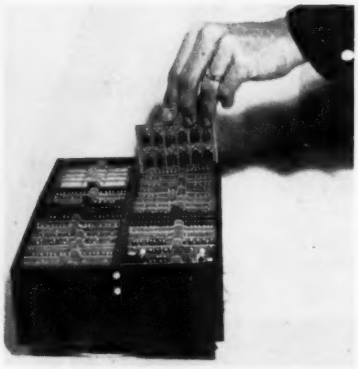
Equipment news

Begins on page 112

tem uses steam from boiler at 40 psi to break fuel oil into a fine mist for firing. During startup, air atomization is used until steam pressure builds up.

Steam atomization is said to provide clean and complete combustion. System has no moving parts; steam flow keeps nozzle clean on shutdown. —Orr & Sembower, Inc

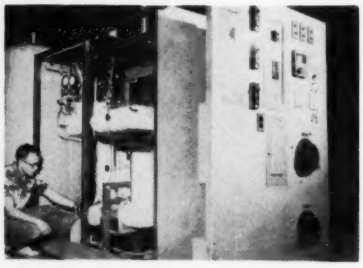
Just circle key numbers on the Reader Service card, page 97, to get complete product story



Analog-to-digital converter

23 • Designed to be air-borne, electronic system weighs 7 lb and is just a little larger than a milk bottle. Completely solid-state converter is used for making high-reliability measurements in data acquisition and reduction systems.

An automatic error-checking system and digital readout are built in. System can be made compatible with any computer code because of building-block construction, maker states. —C G Electronics Corporation



Packaged heat-transfer loop

12 • Development of this packaged system means that colleges and industrial research centers can prepare for the study of liquid-metal

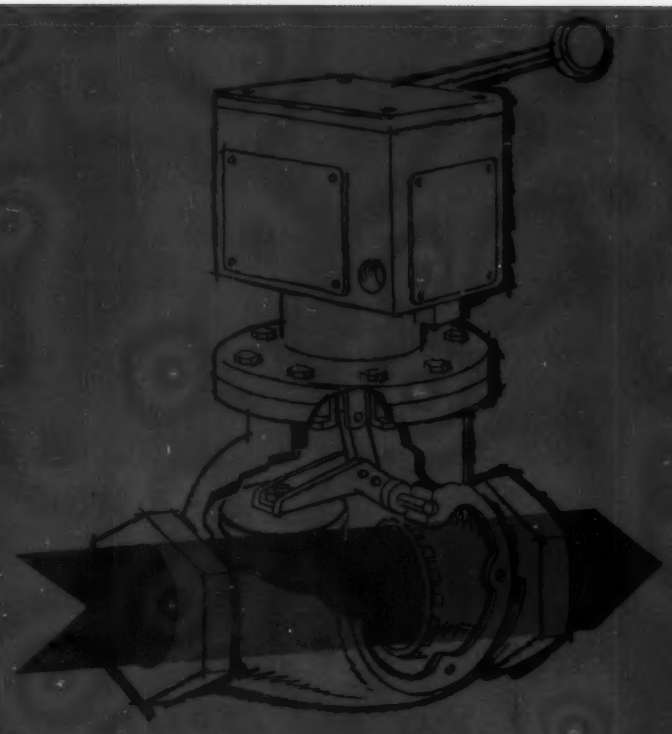
"Which of these major gas valve problems is yours?

capacity?...safety?"

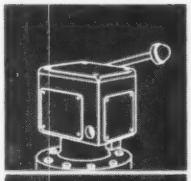
Compare these gas capacities

GAS CAPACITY—1" DROP

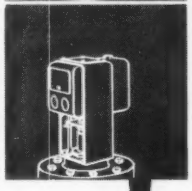
PIPE SIZE (INCHES)	HI-FLO VALVE CU. FT. HR.	HI-FLO VALVE MAX. OPER. PRESS. P.S.I.	HI-FLO VALVE C_V FACTOR	CONVENTIONAL GLOBE VALVE CU. FT. HR.
1 SCR	2,000	50	37.8	920
1¼ SCR	2,700	50	51.0	1,370
1½ SCR	4,000	50	75.6	1,840
2 SCR	8,000	25	151.0	3,570
2½ SCR	12,900	15	244.0	4,500
3 SCR	17,000	15	320.0	6,600
4 FLG	27,000	8	510.0	8,900
6 FLG	54,000	5	1020.0	17,800



CHOICE OF TWO ACTUATORS:



V-116 MANUAL RESET, with lever action—90° handle travel. Held open electrically, spring closed on power interruption.



H-117 HYDRAMOTOR, electric reset, with either fixed opening speed or adjustable opening speed regulated to design of equipment.

"THIS NEW GENERAL CONTROLS HI-FLO GAS VALVE SOLVES BOTH...AND MORE

Straight through flow provides high capacity... minimum pressure drop. And you get an unequalled combination of safety characteristics. *Spring-loaded* inner valve closes with pressure for positive safety shut-off. Direct in-line action without complicated linkage. *Rubber-faced* vertical seating won't scratch or score... assures *tight shut-off*. *Dual release actuator* assures positive closing. Fixed or adjustable opening speeds for specific duty. Line sizes from 1" to 6" pipe. Costs less than valves that can't measure up in quality, performance or adaptability. Check the capacity table... then check the valve out with your nearest General Controls representative."

GENERAL CONTROLS

America's Finest Automatic Controls for Home, Industry and the Military

Glendale, Calif. • Skokie, Ill. • Guelph, Ontario, Canada

Six Plants—42 factory branch offices serving the United States and Canada

For more facts circle 267 on Reader Service card, p 97

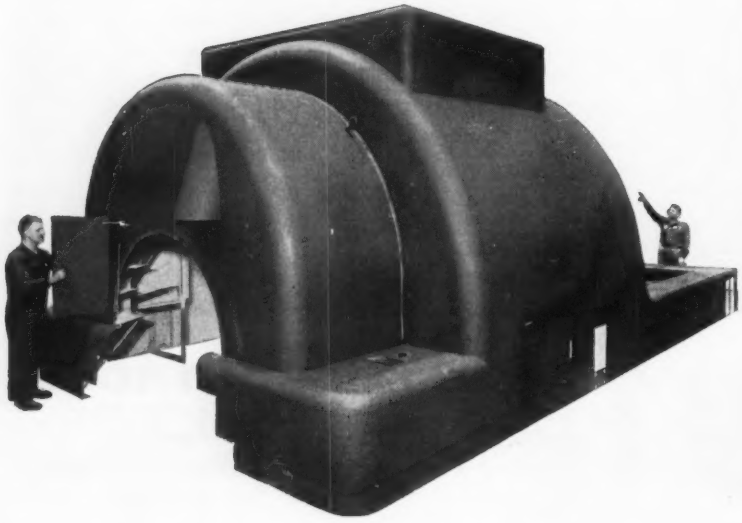
CUSTOM SHEET & PLATE FABRICATION

It takes modern equipment plus craftsmanship and know-how to produce fabrications such as the giant generator housing shown here—illustrative of Kirk & Blum's ability to produce the unusual as well as the conventional types of weldments. In its 170,000 sq. ft. plant, with crane capacity to 25 tons, Kirk & Blum has complete facilities to produce, preassemble and finish a wide variety of carbon steel, stainless, aluminum, monel and other alloys assemblies up to ½" thickness. Fifty years of exceptionally varied experience is your added assurance that the job will be done quickly and economically.

Send prints for prompt quotations or write for detailed literature: The Kirk & Blum Mfg. Co., 3233 Forrer St., Cincinnati 9, Ohio.

ELECTRICAL ENCLOSURES AND HOUSINGS
CONTROL PANELS AND DESKS
BREECHINGS • STACKS • AIR AND GAS DUCTS
CASINGS • LOUVERS • BINS • HOPPERS • CHUTES
INSULATING JACKETING
ALUMINUM AND ALLOY FABRICATION

KIRK & BLUM
FABRICATION

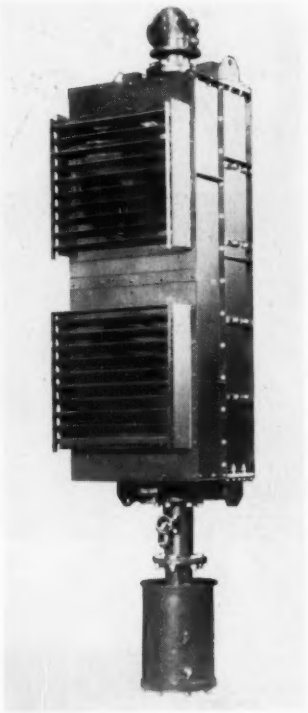


Equipment news

Begins on page 112

heat transfer without spending time in designing, assembling their own high-temperature loops.

All necessary auxiliaries—heaters, coolers, electromagnetic pumps and flowmeters, instrumentation — are built in. Filled with NaK, a low-melting-point sodium-potassium alloy, the loop simulates actual liquid-metal heat-transfer systems for nuclear reactors and chemical processes. Enclosure is easily removed for inspection.—MSA Research Corporation



Improved transformer cooler

26 • Forced-oil-cooled power transformers now come equipped with redesigned coolers. Oil pumps have been moved to a more accessible location at ground level, and slower, quieter fans which move more air are used, with louvers to prevent recirculation by directing air upward. —General Electric Company

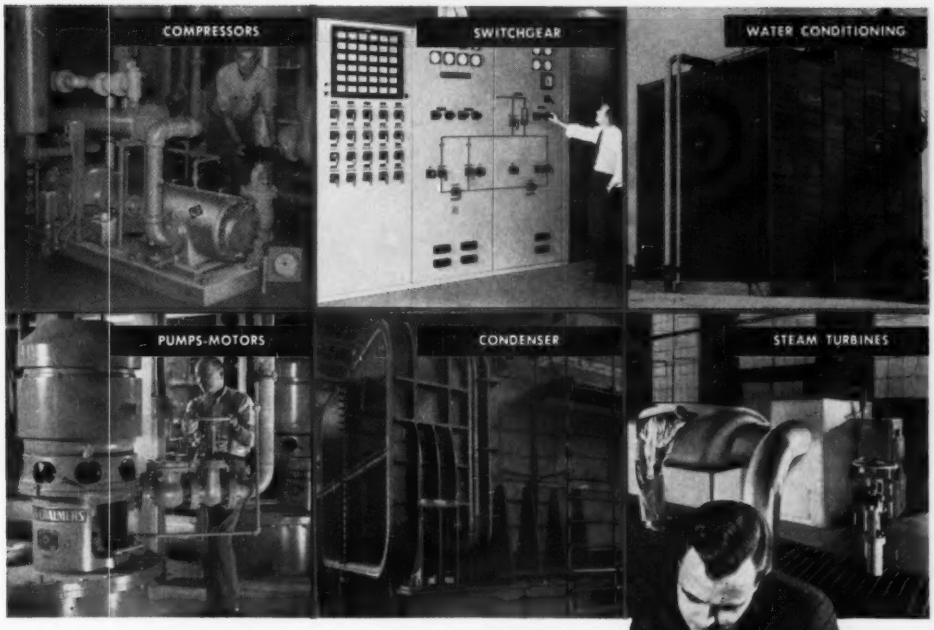
Just circle key numbers on the Reader Service card, page 97, to get complete product stor/

Oriented nylon strip

25 • Laminated with leather or rubber, nylon strip gives strength and flexibility to power-transmission and

In pace with POWER... **ALLIS-CHALMERS**

ALLIS-CHALMERS



ONE MAN...

Your Allis-Chalmers man... can supply and coordinate all this equipment and more

Compressors, switchgear, condensers, steam turbines, motors, pumps and water conditioning equipment — Allis-Chalmers builds them all.

But equipment is not the whole story. You get more, much more than fine equipment when you specify Allis-Chalmers.

- There's the obvious time- and money-saving advantage of single-source buying.
- The coordination of drive to driven part.
- The coordination of engineering and delivery.
- The unit responsibility for equipment in service.

Whatever your power equipment problem may be... there's one man to call — your nearby A-C engineer. His recommendations are backed by experts on the particular equipment involved. *Allis-Chalmers, Milwaukee 1, Wisconsin.*

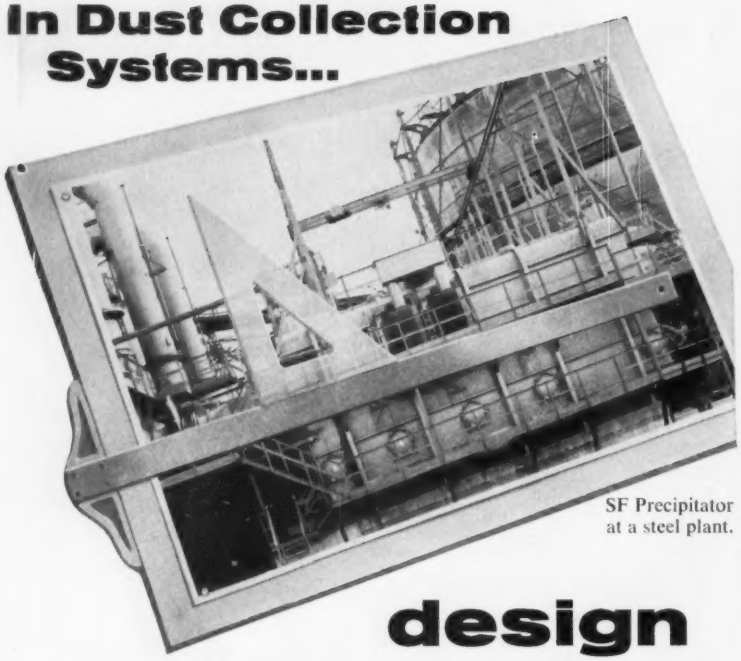
Plan to stay ahead... MODERNIZE!

A-C ALLIS-CHALMERS

A-5991-PR

ALLIS-CHALMERS

In Dust Collection Systems...



SF Precipitator at a steel plant.

design makes the difference

Higher efficiency of Buell 'SF' Electric Precipitators is the result of exclusive engineering features. For example, Buell's *Spiralectrodes* emit 50% to 100% more electrons than other types . . . and *maintain* their efficiency. Positive gas flow control through adjustable baffles prevents scouring and eddying. And Buell's Unique Continuous Cycle Rapping practically eliminates "puffing".

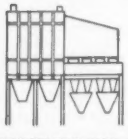
BUELL CYCLONES

Lower installation cost of Buell's time-proved simplified design makes erection faster and easier. Spiralectrodes, for example, are self-tensioning, require no weights. Flexibility of power supply means easier installation, operating safety.

"SF" ELECTRIC PRECIPITATORS

Lower maintenance cost is the result of many details of superior design. And sectionalized design permits shutting down part of a unit without interrupting service in the rest of the unit.

Get full information: write for a copy of "Buell SF Electric Precipitators", a 22-page booklet. Write to Dept. 50-E, Buell Engineering Co., Inc., 123 William Street, New York 38, N. Y.



PRECIPITATOR-CYCLONE COMBINATIONS

buell®

Experts at delivering Extra Efficiency in

DUST COLLECTION SYSTEMS

Equipment news

Begins on page 112

conveyor belts. Now first manufactured in the U.S., strip is "oriented" by changing the direction of its molecular structure, increasing strength.

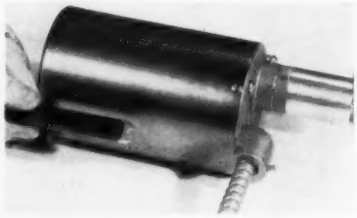
Strip is available in thicknesses up to ⅛ in., widths to 3 in.—Reeves Brothers, Inc

Cable peeler

40 • Tough hide of electric cables can now be peeled cheaper and more safely with a stainless-steel peeler. Unit is hooked over cable, tightened by hand or with a hot stick, then rotated until a chip falls away.

There are 134 different blades available, all interchangeable, each designed for one size of conductor and one covering thickness. An operation formerly taking as long as four hours is now completed in a few minutes, according to manufacturer.—Penn-Union Electric Corporation

Just circle key numbers on the Reader Service card, page 97, to get complete product story



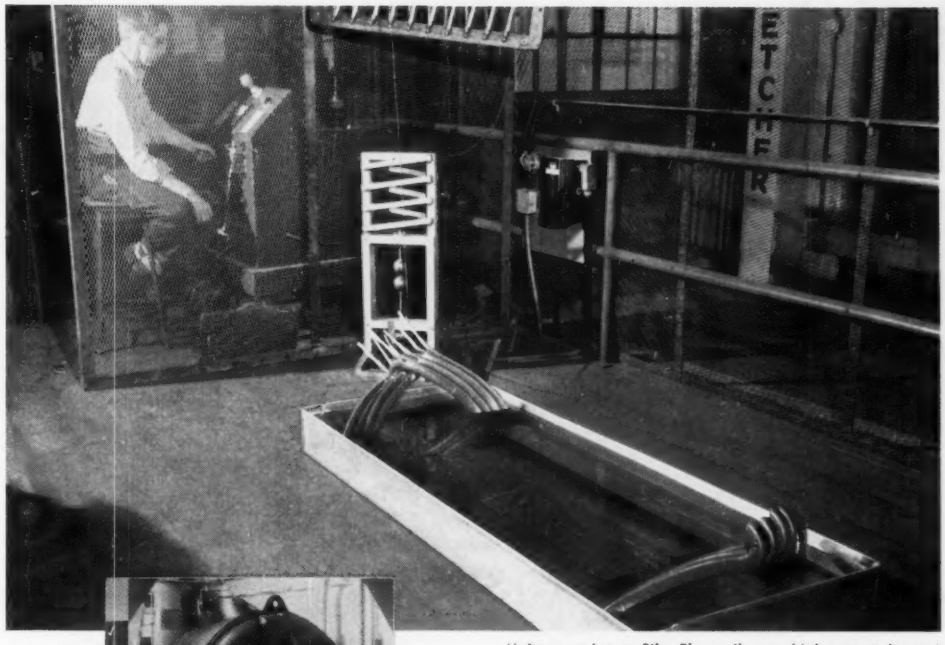
Universal flame detector

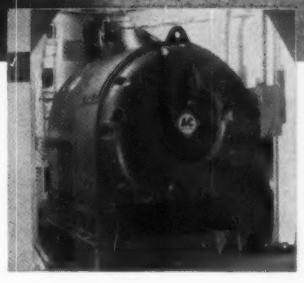
39 • Industry's first universal detection device can be used on all types of commercial and industrial heating or processing burners.

Heart of the system is an ultraviolet-sensitive tube. Amplifier circuit adds up impulses of electrical

In pace with POWER... ALLIS-CHALMERS

ALLIS-CHALMERS





Moisture-resistant *Silco-Flex* coils are high-potential-tested under water, with test voltage applied for one minute between conductor and water bath.

Super-Seal coil foils water

"Hi-pot" tests under water prove moisture resistance

Remarkable insulation systems combined with advanced mechanical features provide a completely new concept in motor protection — the *Super-Seal* motor. This motor gives you complete protection from moisture, fly ash, and other contaminants, even with so-called drip-proof motor enclosures.

New motor is protected with *Silco-Flex* stator coil insulating system: A homogeneous, void-free dielectric barrier of vulcanized silicone rubber so moisture-proof it can be hi-potted under water, cleaned by hosing down. Resists most corrosive or chemical atmospheres.

Integrated field coils in synchronous machines are completely sealed against contaminants, bonded and locked against mechanical forces.

For additional information, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Plan to stay ahead... MODERNIZE!

Super-Seal and *Silco-Flex* are Allis-Chalmers trademarks.

A-C ALLIS-CHALMERS

A-5992-PR

ALLIS-CHALMERS

PARIS

Electrama

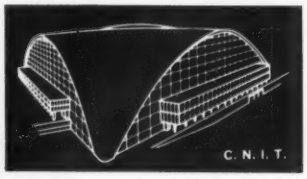
JUNE 12th to 28th, 1959

FIRST GENERAL EXHIBITION OF THE FRENCH ELECTRICAL ENGINEERING INDUSTRIES AND OF THE APPLICATIONS OF ELECTRICITY IN MODERN LIFE

Electrama, spectacular display of the most up-to-date electrical, electro-mechanical, nuclear equipment, etc.... as well as their utilizations by public services and big industries.

Electrama world meeting of the people that count in the industrial, administrative and scientific fields, will take place *during the Paris season from June 12th to 28th, 1959,* in the most modern Exhibition Palace: The "Centre National des Industries et des Techniques" (C.N.I.T.).

Electrama offers its assistance in connection with the visit of its foreign guests to France (hotels, visits of plants and big industrial installations in France, meetings with French personalities and technicians, etc....). Multi-lingual personnel and a well-equipped reception department will be at their disposal.



*25% reduction on French Railways and most foreign railway systems.

For information apply to the Commissariat General,
14, Rue de Magdebourg, Paris 16e

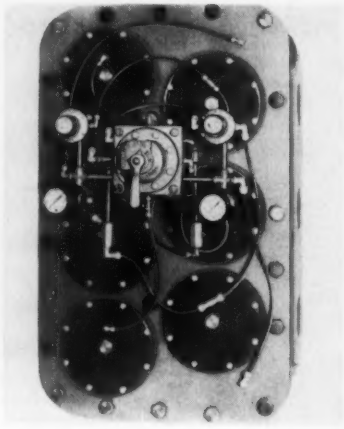
Electrama will take place at the same time as the Air Show which will include an important participation of the Electronics Industry and the Chemistry Exhibition in Paris.

Equipment news

Begins on page 112

energy generated by the tube as it counts ultraviolet rays present in all types of flame.

Output of two microamp from the tube indicates a minimum satisfactory flame condition for safe burner operation. Unit can be used with all fuels, including gas-oil combinations, on single and multiple burners. List price is $120. — Minneapolis-Honeywell Regulator Company



Hydromatic valve

13 • Single control valve can be manually operated by turning lever to backwash, brining, rinse and service without using gate valves.

Body is made of cast iron with removable cover. Inside are six individual diaphragm-operated valves, hydraulically controlled by a small pilot rotary-disk slide valve. Two are always open, other four closed.

Unit is said to be nonleaking, nonscoring and easy to maintain. It provides automatic control of backwash and rinse flow rates with no hydraulic shock.—Cochrane Corporation

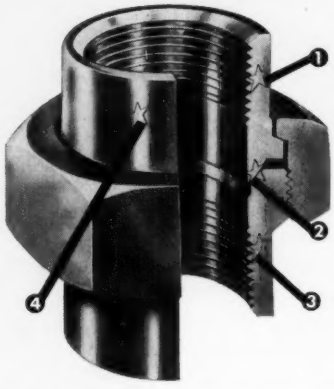
Just circle key numbers on the Reader Service card, page 97, to get complete product story

Nickel-manganese electrode

30 • Moderate-cost alloy is good for tough, wear-resistant hard surfacing and for strong, ductile welds. Low-hydrogen ac-dc electrode is recommended for joining and wear-surfacing austenitic manganese and carbon steels.

Welded properties include: yield strength, 58,000 psi; tensile strength,

only
CATAWISSA
gives you all these features for your forged steel pipe union requirements



1. **Uniform walls** for even expansion and contraction under temperature changes. They follow the pipe!

2. **Catawissa Ball-to-Angle Seats** give you a "Perfect Seal" regardless of pipe alignment!

3. **More than adequate** wall thicknesses give you Catawissa's 3-to-1 Safety Factor (3000-lb. service, 9000-lb. test; 6000-lb. service, 18000-lb. test)!

4. **Round, straight barrels** for fast wrenching. No uneven or tapered surfaces to cause wrench slips or wrench locking!

Catawissa Perfect Seal Pipe Unions are made by Union Specialists from 80,000 lb. tensile strength steel (ASTM Spec. A-105-55T, Grade II). Steel forgings from our own forging mill are closely checked for imperfections . . . and finishing on modern, automatic machines with close inspection during and after production give you pipe unions second to none!

Write for Catalog 58 showing the complete Catawissa line of Perfect Seal Products.

for complete, guaranteed satisfaction

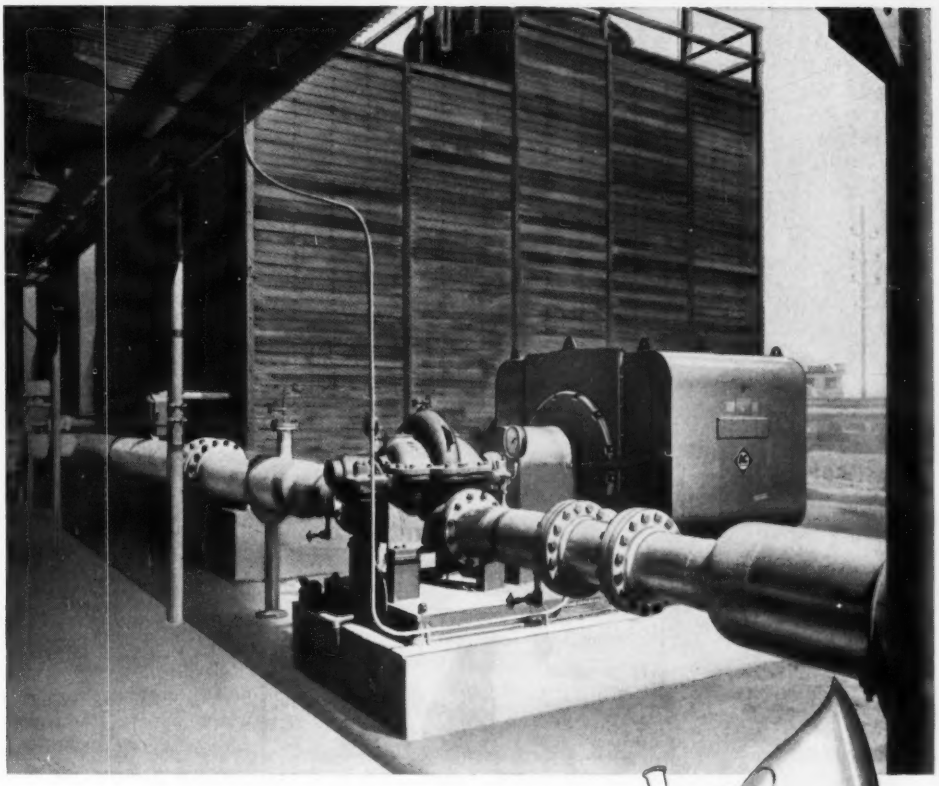
. . . always specify
CATAWISSA

CATAWISSA VALVE & FITTINGS CO.
CATAWISSA • PENNSYLVANIA

circle 272 on Reader Service card, p 97
circle 273 on Reader Service card, p 97

ALLIS-CHALMERS

In pace with POWER... ALLIS-CHALMERS



CONTROL ALGAE

easy, low-cost way

Eliminate problems of plugged pump strainers, coated heat-exchanger tubes and coated slots in cooling towers.

Control is safe . . . quick with Allis-Chalmers No. 120 Series Algaecide.

This algaecide is toxic to more algae than any other. On the other hand, it has low toxicity to fish or animals and is extremely safe to handle. Even in concentrated form it is only a mild irritant to skin and hands.

A little goes a long way! Only 2 to 5 ppm are required for effective dosage of most organisms. It's easy to feed into the system . . . and is non-oxidizing and corrosion inhibiting.

No water conditioning specialist needed to use it! Buy it and try it. Purchase directly from your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Plan to stay ahead... MODERNIZE!

A-C ALLIS CHALMERS

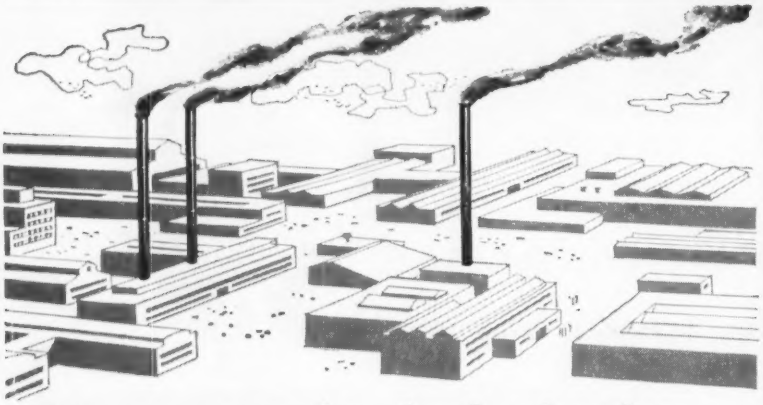
A-5972-PR

ALLIS-CHALMERS

Replacement Tubes

BOILER TUBE
COMPANY OF AMERICA
McKEES ROCKS, PA. (Pittsburgh District) Federal 1-7750

For more facts circle 275 on Reader Service card, p 97



Glass-protected stacks...

Permaglas® smokestacks are glass-protected(inside and out)... are virtually impervious to condensate corrosion

* Accelerated life tests prove that *Permaglas* stacks last 3 to 5 times longer than plain steel stacks
* *Permaglas* stacks are easy to install—no special equipment needed

Write for the money-saving facts . . . get Bulletin SS-202

Through research ...a better way
A.O.Smith
CORPORATION
PERMAGLAS SMOKESTACK SALES
PROCESS EQUIPMENT DIVISION
MILWAUKEE 1, WISCONSIN

A. O. Smith Corporation, Dept. P-59, Milwaukee 1, Wisconsin
Gentlemen: Please send me a copy of the Permaglas Smokestack Bulletin No. SS-202.

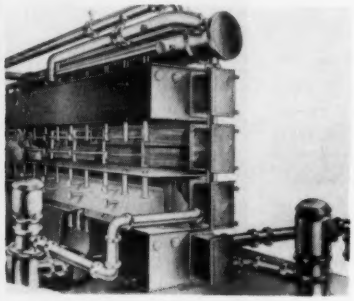
Name_____ Title_____
Firm_____
Address_____
City_____ Zone_____ State_____

For more facts circle 276 on Reader Service card, p 97

Equipment news

Begins on page 112

125,000 psi; elongation in 2 in., 50%; hardness after work hardening, 44-50 Rockwell C.—All-State Welding Alloys Co, Inc

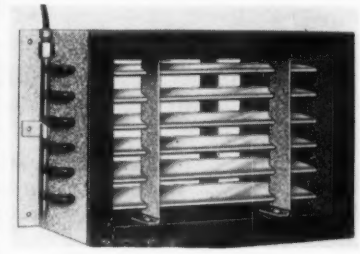


Flash evaporator

29 • Built for the Shiekdom of Kuwait, 4-stage evaporator produces 630,000 gpd of fresh water from salt water.

Unit works by reducing pressure on heated water below vapor pressure, causing flash evaporation; vapor is then condensed. Units use a closed recirculating system, in which chemically treated makeup water is continuously added. The closed cycle makes chemical treatment feasible, which permits continuous operation without shutdown for removing scale. Vertical design cuts space needs.—Westinghouse Electric Corporation

Just circle key numbers on the Reader Service card, page 97, to get complete product story

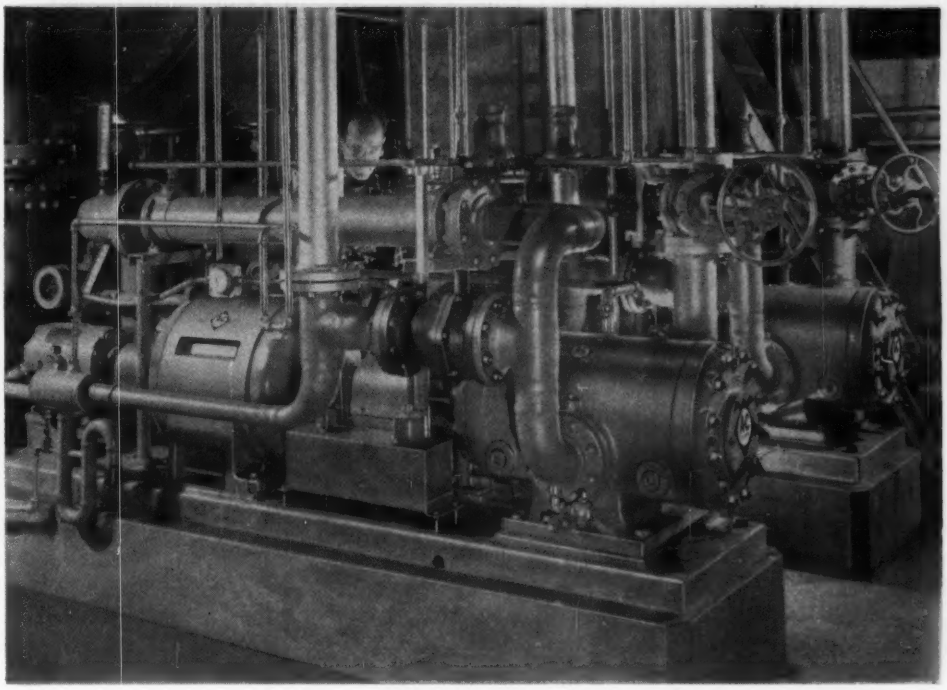


High-velocity air valve

14 • *Pneumafoil* is a high-velocity valve which operates without motors or linkage mechanism of any kind. A 15-psi pneumatic control system uses airfoil vanes, each enclosing a sealed neoprene actuator connected to control air. As air pressure is increased, actuators inflate and expand the vanes, constricting open area between vanes and throttling the air

ALLIS-CHALMERS

In pace with POWER... ALLIS-CHALMERS



Ro-Flo vacuum pumps reduce pressure in condenser in power plant.

Smooth and Tough

Eliminate high maintenance with Ro-Flo compressors and vacuum pumps

Ro-Flo units can take it! They're being used successfully on hundreds of jobs, including: shop air, air tools, condenser vacuum pumping, air hoists, cleaning, sandblasting, riveting, sewage ejectors, peak shaving of gas and air drilling.

The inherent wear and tear from the vibration and shock of reciprocating machines is eliminated in the smooth *Ro-Flo* rotary action. The fall-off in efficiency, inevitable with other units, never takes place with a *Ro-Flo* compressor. And the tough sliding vanes operate for thousands of hours before new ones are slid into place in a job that takes only 30 minutes.

For smoothness, for toughness, for easy maintenance and simplest installation, choose *Ro-Flo* compressors.

Contact your nearby A-C office, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

Plan to stay ahead... MODERNIZE!

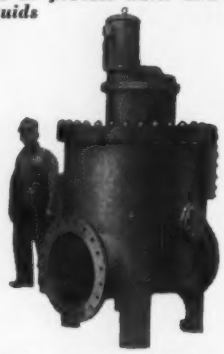
Ro-Flo is an Allis-Chalmers trademark.

A-C ALLIS CHALMERS

A-5960-PR

ALLIS-CHALMERS

More clean water at a lower cost with
S.P. KINNEY AUTOMATIC SELF-CLEANING
STRAINERS
. . . for efficient removal and disposal of suspended particles from raw or process water and other liquids



✓ Over 1000 installations
✓ 2" to 48" pipeline sizes
✓ Installation on pressure or suction side of pump

Write today for Bulletin 500.1P

S.P. KINNEY ENGINEERS, Inc.
CARNEGIE, PENNSYLVANIA

circle 278 on Reader Service card, p 97

ANY COMPLAINTS?

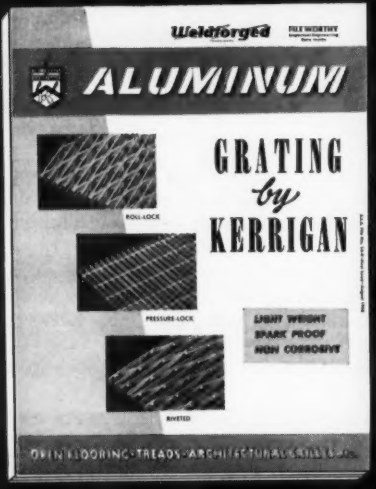
. . . postal service?
. . . late delivery?
. . . lost copies?
. . . mail gone astray?

Maybe we don't have your complete address.
A complete address includes a

Postal Zone Number

POWER
330 West 42nd Street
New York 36, N. Y.

NEW ALUMINUM GRATING CATALOG
SEND FOR YOUR FREE COPY



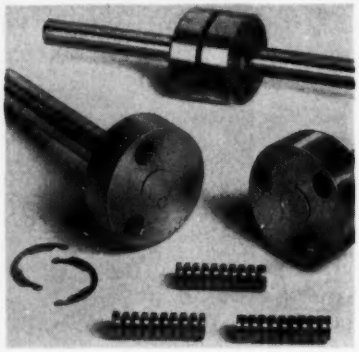
KERRIGAN IRON WORKS, INC. - Dept. PO-5 — Nashville, Tenn.
Please send me your new aluminum grating catalog containing engineering data.
NAME _____
FIRM NAME _____
CITY _____ STATE _____

Equipment news

Begins on page 112

flow. When expanding vanes make contact, complete shutoff is achieved with minimal leakage.

Aluminum construction prevents corrosion. For dual-duct applications, two valves are mounted in a mixing box. Air capacities range from 1500 to 9600 cfm.—Connor Engineering Corp

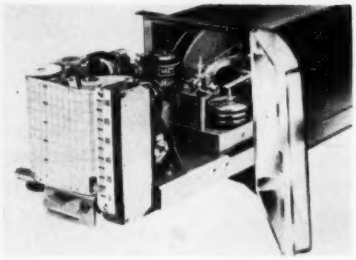


Free-aligning coupling

38 • No nuts or bolts are used in this coupling. Unit is simple in design, can be connected or disconnected with a screwdriver. Halves of the coupling are joined and transmit thrust through helical wire springs, held in place by snap or split rings. Unit operates in either direction of rotation and can be installed vertically without changing parts.

Couplings have a load factor of 7:1, are standardized in three series: *light*, for shaft sizes to 2-in. dia; *medium*, 2- to 5-in. dia; *heavy*, 5 to 12-in. dia. —Atomatic Manufacturing Co

Just circle key numbers on the Reader Service card, page 97, to get complete product story

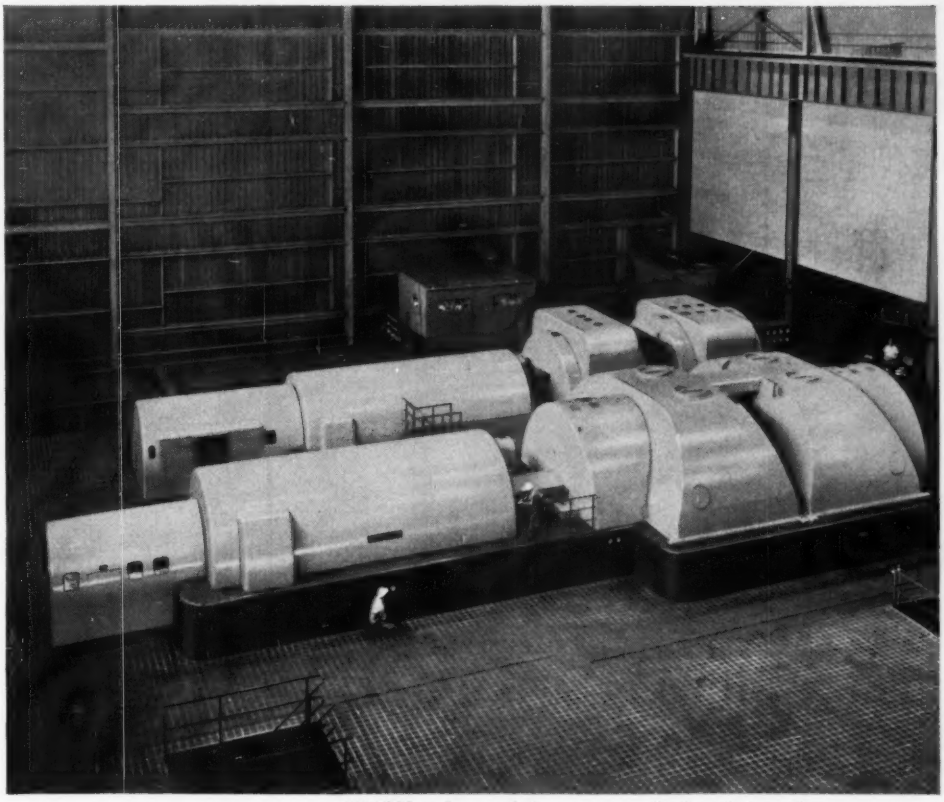


Pneumatic transmitters

21 • Potentiometers, pyrometers, ac and dc bridges and differential transformer receivers with pneumatic output continuously transmit a 3-15 psig

ALLIS-CHALMERS

In pace with POWER... **ALLIS-CHALMERS**



321,500-kw, close-coupled, cross-compound reheat design with two generators... one on 3600-rpm shaft... and one on 1800-rpm shaft. Steam conditions: 2400 psig, 1050 F at inlet; 1000 F reheat; 1 inch Hg absolute exhaust pressure.

ALLIS-CHALMERS

Detroit Edison's new 321,500-kw machine goes on the line

River Rouge Unit 3 increases the capacity of the Detroit Edison system to 3¼ million kilowatts — double its capacity of 10 years ago.

In size, in design, this steam turbine-generator unit was the beginning of a new era in power generation.

Of special interest are the record size 46-inch exhaust blades; and the close-coupled arrangement with the crossunder piping located above the foundation which made it possible to build to compact over-all dimensions.

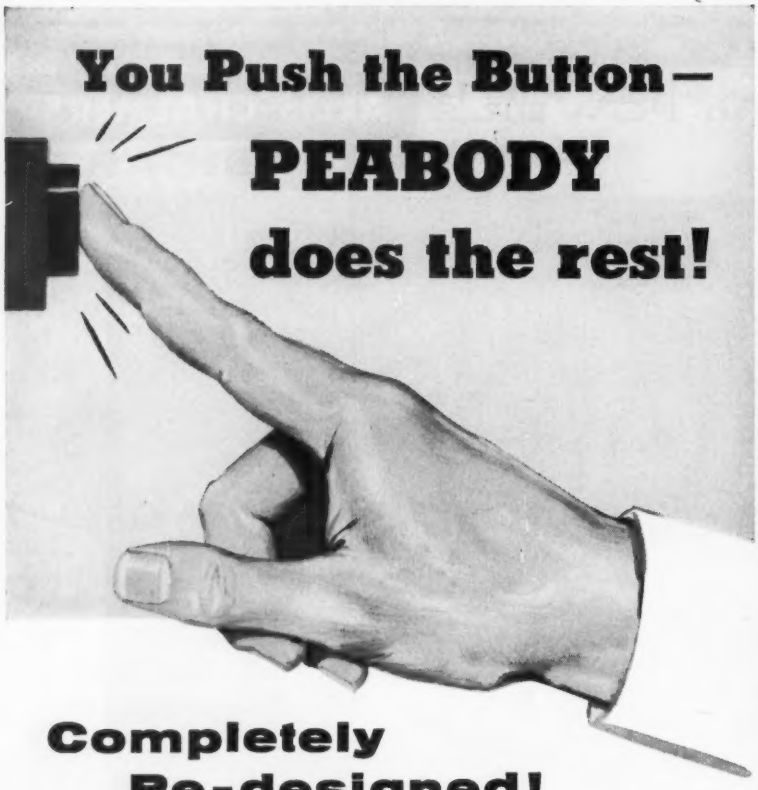
For an interesting discussion of this turbine, see ASME paper 58-SA-22 . . . available through your nearby A-C office or Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Plan to stay ahead... MODERNIZE!

A-C ALLIS-CHALMERS

A-5938-PR

For more facts circle 280 on Reader Service card, p 97



Completely Re-designed!

The Peabody PK-54 Fuel Burner Automatically—

- Recirculates hot oil before start-up
- Purges the furnace before start-up
- Proves ignition before start-up
- Operates quietly
- Burns oil or gas
- Follows the load demand
- Maintains efficient combustion at all loads
- Shuts down if load ceases
- Purges furnace after shut-down
- Relights when load resumes, *after* satisfying all safety requirements
- Shuts down and *locks out* on:

Power failure • Ignitor failure • Main flame failure • Combustion air failure • Atomizing steam failure • Excessive fuel pressure • Deficient fuel pressure • Deficient oil temperature • Any preselected operating factor

This safe, efficient, dependable unit provides exactly what you need for your plant.

Write today for new bulletin 430-B.

PEABODY ENGINEERING CORPORATION

232 MADISON AVENUE, NEW YORK 16, N.Y

OFFICES IN PRINCIPAL CITIES

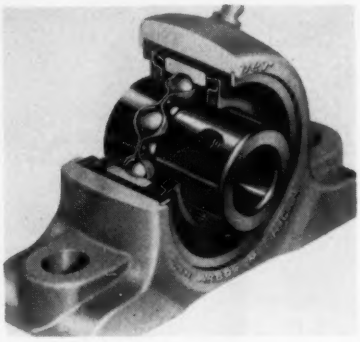
B-361 *PEABODY LIMITED • LONDON, S.W 1, ENGLAND*

Equipment news

Begins on page 112

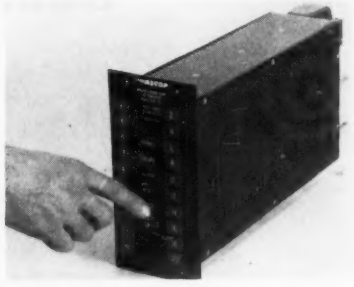
signal. Transmitters retain features of electronic instruments, but are suitable for use with pneumatic instruments. *Series 663* is adaptable to ratio, cascade and computer type control systems, and has the plug-in convenience of the pneumatic line.—The Bristol Company

Just circle key numbers on the Reader Service card, page 97, to get complete product story



Sound-conditioned bearings

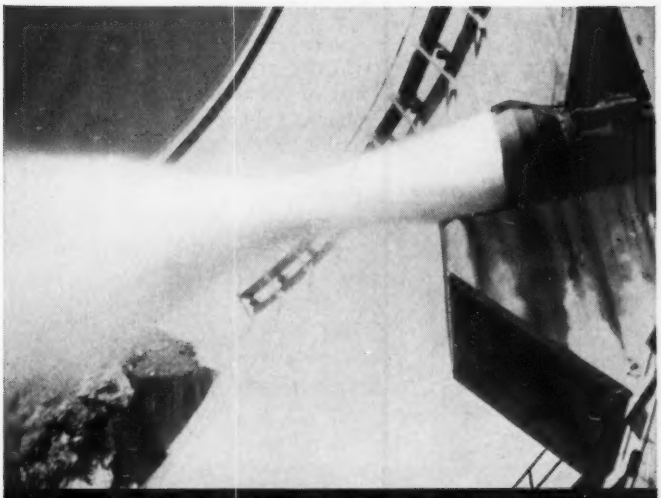
37 • Pillow-block ball bearings are designed for extremely quiet operation. A synthetic-rubber cushion between outer ring of bearing and pillow-block housing insulates against vibration and suppresses noise. Housings are of a lightweight, ductile material. The units are available in five shaft sizes from ½ through 1 in.—Hoover Ball and Bearing Company



Fault-finder alarm system

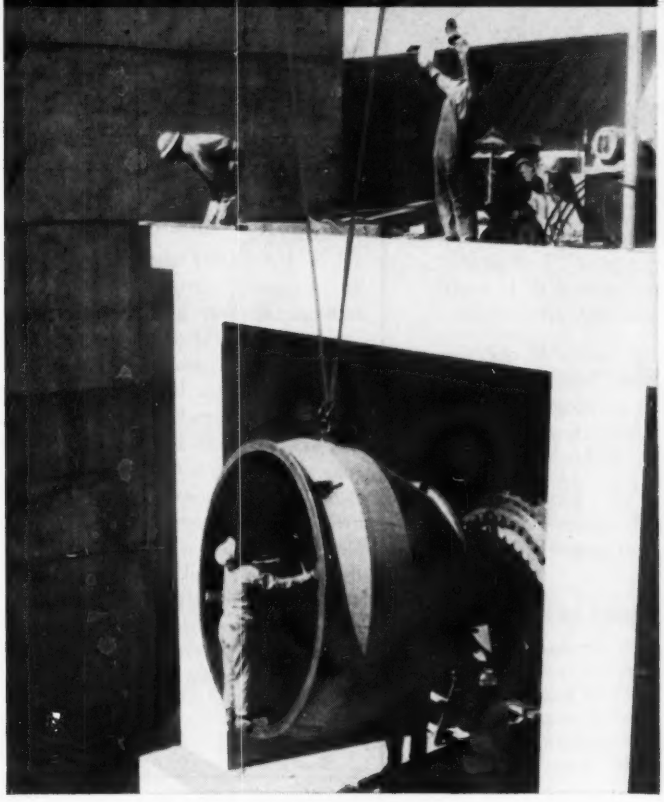
20 • Solid-state components, no moving parts are features of this alarm system for long- or short-distance monitoring. System is designed for monitoring electrical substations, industrial plant operations.

Basic receiver-annunciator unit, above, receives pulses from a remote scanner-transmitter, indicating nor-



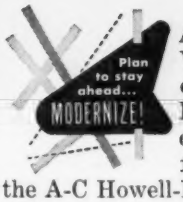
This 18-inch Ring-Jet Valve, installed by the City of Bremerton, Washington, is manually operated. Under a 115-foot design head, it discharges 76 MGD when fully opened. Note how the hood concentrates the discharge stream.

One of two 66-inch A-C Ring-Jet Valves during final assembly at Tulloch Dam, California. These valves are used for an irrigation bypass, operate under a 145-foot head.



RING-JET VALVES

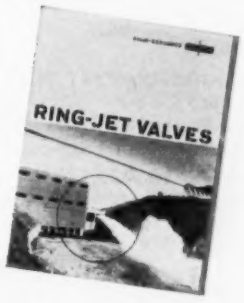
for easy regulation and control of water under free discharge



Allis-Chalmers Ring-Jet Valves are a logical development from the Howell-Bunger Valve. For use under high- and low-head, free-discharge conditions, the A-C Howell-Bunger creates a substantial amount of spray in providing maximum dispersion to minimize erosion. Now, in the A-C Ring-Jet Valve, the addition of a steel hood creates a concentrated jet, reduces spray, and helps dissipate the energy in the discharged water.

This new A-C Ring-Jet Valve gives you the simple construction, radially-balanced hydraulic design and easy operation of the A-C Howell-Bunger Valve, while very nearly matching its high discharge coefficient. Ring-Jet Valves are available with standard manual and/or motor-driven operators. Hydraulic operation can be provided, and is especially applicable to the larger sizes and higher head applications.

To obtain complete information on the A-C Ring-Jet Valve, contact your nearest Allis-Chalmers office, or write Allis-Chalmers, Hydraulic Division, York, Penna.



Hydraulic Division RESEARCH DESIGN HYDRODYNAMICS ENGINEERING FABRICATION

Hydraulic Turbines & Accessories • Pump-Turbines • Pumps • Liquid Heaters
Rotovalves • Ball Valves • Butterfly Valves • Free-Discharge Valves

ALLIS-CHALMERS

For more facts circle 282 on Reader Service card, p 97

MOST COMPLETE LINE

Eleven Product Groups Serve Every Sealing Need

GROUP NO. 2

Valve Stem Packings

Braided and twisted Asbestos types and monel wire inserted braided asbestos over plastic core, for low, medium and high pressure steam at temperatures up to 800° F, and for hot water, hot oil, gas and air service.

Also, for valves handling corrosive chemicals, Belmont offers Teflon* molded valve rings; braided Teflon yarn packings; braided Teflon-impregnated blue and white asbestos Packings; Shredded Teflon Plastic Packings; for temperatures to 500° F.

See your Belmont Distributor or write for the name of the one nearest you.

OTHER BELMONT PRODUCT GROUPS

1. High Pressure Asbestos Packings
3. Rotary Pump Packings & Seals
4. Criss-Cross Braided Packings
5. Hydraulic Packings
6. Bel-Vee V-Rings
7. Sheet Packings
8. Gaskets
9. Metallic Packings
10. Plastic Packings
11. Expansion Joints

*du Pont Trademark

MOST CONVENIENTLY AVAILABLE

Nationwide Industrial Distributor Organization Provides On-the-Spot Service

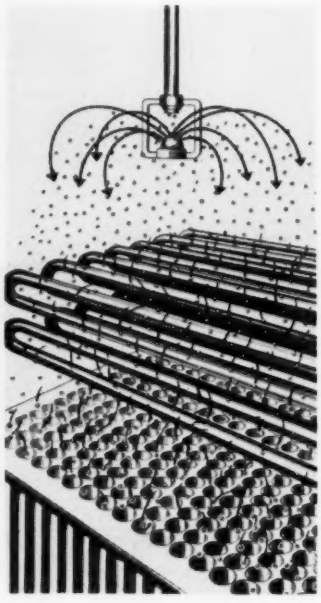
BELMONT

The Belmont Packing and Rubber Company
Butler & Sepviva Streets, Phila. 37, Pa.

Equipment news

Begins on page 112

mal or off-normal conditions at 20 points. Off-normal is announced by flashing light and audible alarm.— Applied Science Corporation of Princeton



Boiler shot cleaning

15 • Irregularly shaped steel shot are cascaded through tubular air heaters and over horizontal surfaces such as superheaters, economizers and reheaters, removing ash and soot. Shot drop by thousands and are evenly spread by distributors. They cascade and ricochet uniformly. removing deposits in small particles.

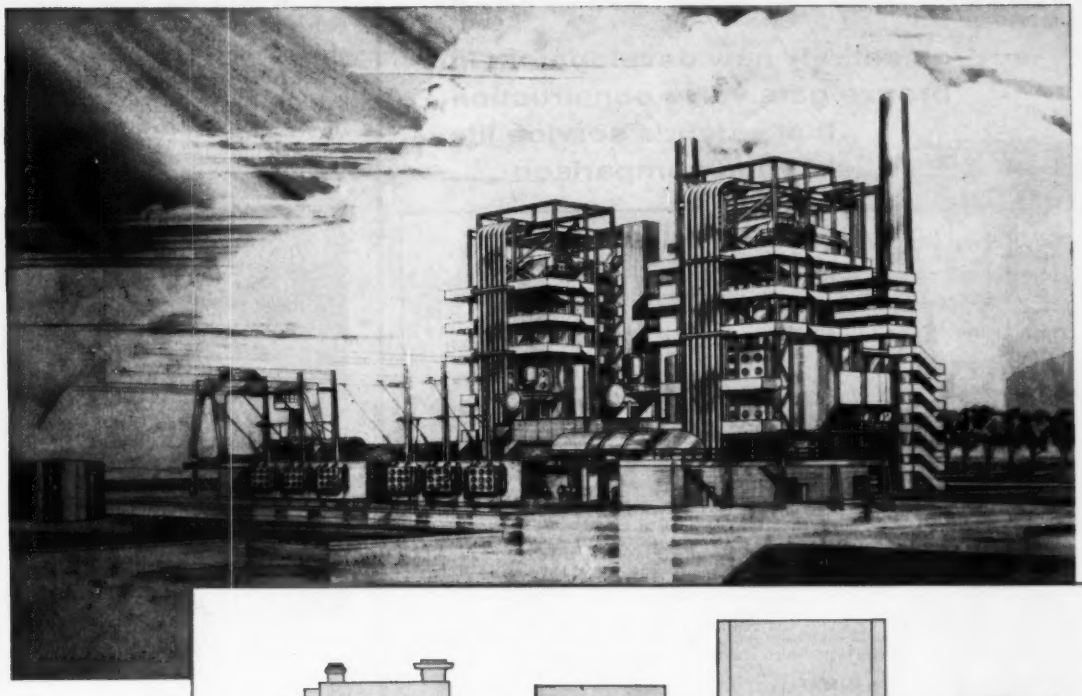
Most of the loosened ash is carried away by gas stream. Heavier particles fall into hopper, recirculate with the shot until broken fine enough to pass out with the gas. Manufacturer has recently acquired U.S. rights to the European Broman-Ekstrom system, to supplement former shot-cleaning program. — Diamond Power Specialty Corp

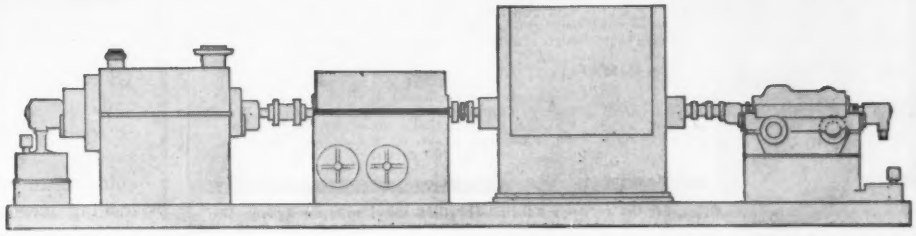
Just circle key numbers on the Reader Service card, page 97, to get complete product story

Powerful data processing

17 • Ultrafast transistors in unit's central processor make this computer up to five times faster than its predecessor. Unit can perform 210,000 additions or subtractions in one sec-

For Southern California Edison Company's
new Huntington Beach Steam Station...





CHTA boiler-feed pump

HMTA condensate booster

Ingersoll-Rand pumps will handle all boiler-feed water

WHEN completed, Southern California Edison Company's new Huntington Beach Station will have a name plate capacity of 820 MW of power ... with four cross-compound turbines and oil-and-gas fired boilers. For the first two units now under construction, Southern California Edison (and Bechtel Corp., engineer and constructor) has purchased 10 Ingersoll-Rand pumps to handle all boiler-feed water.

One of the arrangements of boiler-feed pump and condensate-booster pump is shown above. The feed pump at left is an I-R double-case pump rated 2020 gpm at 6400 ft TDH. The booster pump at the opposite end of the driver is an I-R horizontally split unit rated 1850 gpm at 1970 ft TDH.

In addition, I-R is supplying the axial inlet surface condensers for each generator unit... plus the condensate, circulating and heater drain pumps, vacuum pumps and steam-jet ejectors.

When you consider equipment to meet your own power plant requirements, call on your Ingersoll-Rand representative for objective, expert counsel. Let him help you select the *right pump* for each of your applications.

Ingersoll-Rand

10-875 11 Broadway, New York 4, N. Y.

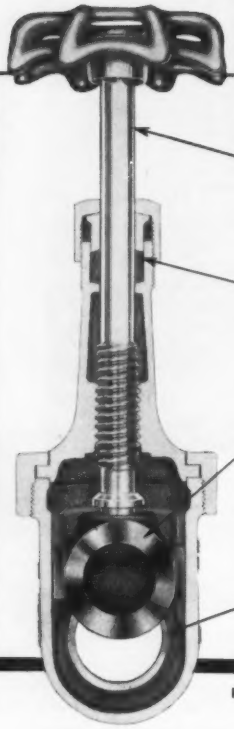
THERE'S NO SUBSTITUTE FOR EXPERIENCE IN ENGINEERED PRODUCTS

For more facts circle 284 on Reader Service card, p 97

Outstanding Valve performance with

KENNEDIZED DISCS

an entirely new development in bronze gate valve construction that extends service life beyond comparison . . .



PROVEN BY USE!

KENALLOY STEM . . .

Exclusive KENNEDY alloy that prevents dezincification and corrosion and provides smooth, non-galling threads and bearing surfaces. In a rugged use test, this stem withstood a mechanical loading of 18 foot-pounds closing torque and after 25,000 cycles was like new!

PACKING . . .

New type packing made of molded graphite asbestos with a Buna "N" binder required no replacement during or after 25,000 cycles.

KENNEDIZED DISC . . .

In punishing use tests, the super mirror finish of the KENNEDIZED disc actually improved with wear! Disc showed no galling or other wear marks after 25,000 cycles at 150 lbs. saturated steam pressure. This remarkable wear resistance is combined with an extremely low coefficient of friction, smooth sliding properties, excellent anti-seizure characteristics and corrosion and galling resistance. Tests and in-use results prove these discs set a new and unmatched high standard in valve performance.

SEAT . . .

Due to the low coefficient of friction and smooth sliding properties, the action of the KENNEDIZED disc actually improved the finish on the seat. Here, again, no galling was found on the seat after 25,000 cycles.

For the complete KENNEDIZED DISC story, write for Bulletin 574.

Fig. 525KD
125-Pound S.W.P.
Bronze Gate Valve.

KENNEDIZED DISCS
NOW AVAILABLE IN THESE KENNEDY VALVES . . .

FIG. 427KD
125-Pound S.W.P. Bronze Gate Valve—Non-Rising Stem, Inside Screw, KENNEDIZED Wedge Disc.
WORKING PRESSURES: Saturated Steam, 125 lbs.; W.O.G., Non-Shock, 200 lbs.

Fig. 525KD
125-Pound S.W.P. Bronze Gate Valve—Union Bonnet, Rising Stem, Inside Screw; KENNEDIZED Wedge Disc.
WORKING PRESSURES: Saturated Steam, 125 lbs., W.O.G., Non-Shock, 200 lbs.

Fig. 78KD
200-Pound S.W.P. 550° F. Bronze Gate Valve—Union Bonnet: ¼"-2"; Bolted Bonnet: 2½"-3"; Rising Stem, Inside Screw; KENNEDIZED Wedge Disc.
WORKING PRESSURES: Steam at 550° F., 200 lbs.; W.O.G., Non-Shock, 400 lbs.

Fig. 518KD
300-Pound S.W.P. 550° F. Bronze Gate Valve—Union Bonnet: ¼"-2"; Bolted Bonnet: 2½"-3"; Rising Stem, Inside Screw; KENNEDIZED Wedge Disc.
WORKING PRESSURES: Steam at 550° F., 300 lbs.; W.O.G., Non-Shock, 600 lbs.

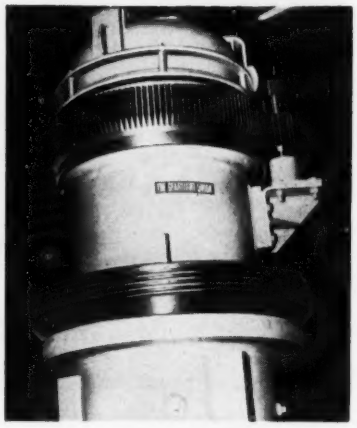
KENNEDY VALVE MFG. CO.
ELMIRA, NEW YORK

• OFFICE AND WAREHOUSES IN PRINCIPAL CITIES

DUCTILE IRON VALVES • CAST IRON VALVES • BRONZE VALVES • INDICATOR POSTS • FIRE HYDRANTS

ond. It reads and writes simultaneously at the rate of 3,000,000 units of information a second.

Long-life transistors increase reliability, decrease maintenance. *Model 7090* costs about $2,880,000.—International Business Machines Corp



Confined-space coupling

18 • Unit facilitates joining pipe and tubing, where space is limited or where remote-control operation is needed. Made up of a conventional coupling to which a gear and pinion locking mechanism has been added, unit is useful where there is no room to use a wrench at right angles to pipeline. One application, above, permits access into the control-rod standpipes of a nuclear power reactor. Patented by Geartight Unions, Ltd of England, device is manufactured by—Stanat Manufacturing Co, Inc

Fire-resistant hydraulic fluids

32 • Synthetic fluids are for use in heavy-duty installations involving radial-piston pumps and high pressures. *Pyrogard* fluids are made in four viscosities, two different types, to satisfy requirements of high-pressure circuits and installations with high fluid-circulating temperatures. —Socony Mobil Oil Company, Inc

Just circle key numbers on the Reader Service card, page 97, to get complete product story

Mercury-vapor lamp

19 • Double-resistor double-electrode lamp is said to be efficient and dependable. Lamps will start under

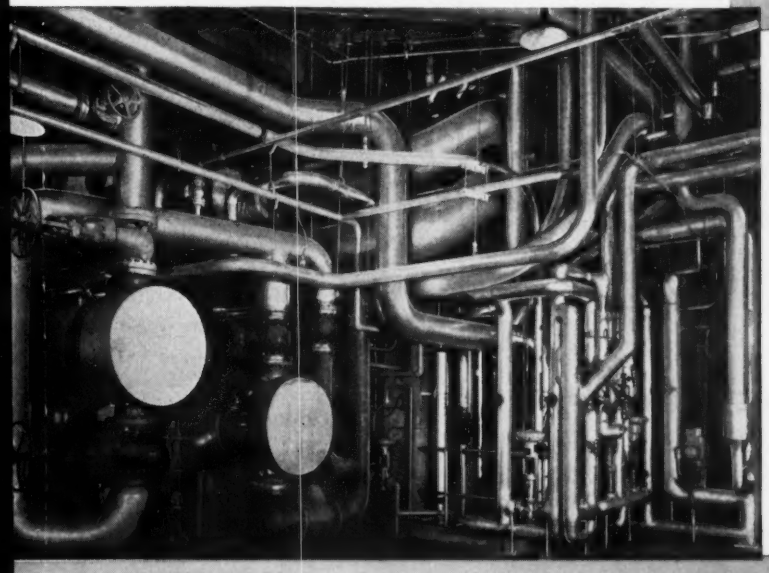
He's Looking For MONEY

Midwest Piping at Kyger Creek plant which has a capacity of 1,075,000 kw and is the largest power plant piping contract (combining fabrication and erection) ever performed by a single contractor.

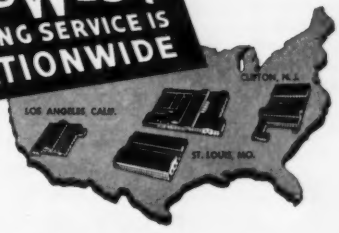
This Midwest Piping Engineer is going over the customer's piping drawings in the light of his long experience in shop fabrication and field erection. He's looking for ways of doing a piping construction job better and at less cost.

Before a construction job is placed in the Midwest shops for fabrication, experienced engineers prepare Field Erection Sketches dividing each line into a series of subassemblies. These Sketches minimize and simplify the field welding . . . the difficult work is done in our well-equipped shops. They also disclose any discrepancies before fabrication instead of during erection. All erection planning has been done by our engineering staff . . . which reduces field thinking and eliminates guesswork. Erection is from these sketches instead of from the design engineers drawings . . . this speeds up the work and results in a real cost saving and earlier completion of the job.

The next time you have a piping job, you'll find it profitable to call in Midwest.



MIDWEST PIPING SERVICE IS NATIONWIDE



MIDWEST PIPING COMPANY, INC.

Main Office: St. Louis 3, Missouri (P.O. Box 433)

PLANTS: ST. LOUIS, CLIFTON, N. J. and LOS ANGELES

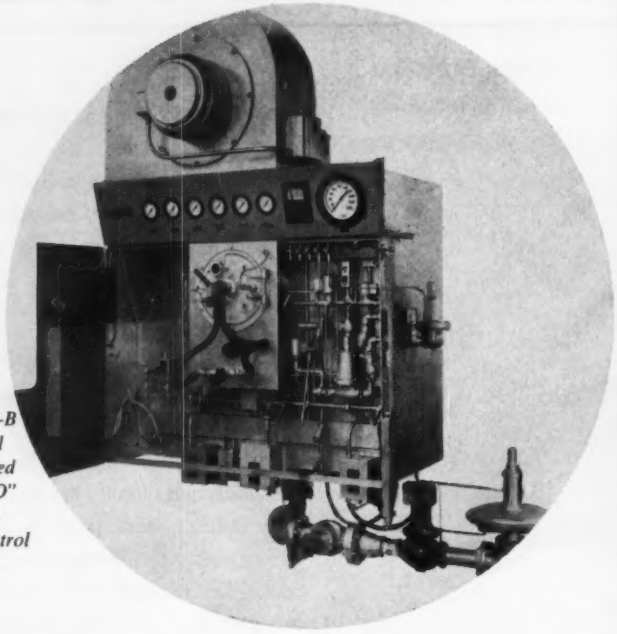
SALES OFFICES:

Asheville (Box 446, Skyland, N. C.) • Atlanta 9—72 Eleventh St. N.E. • Boston 27—426 First St. • Chicago 3—79 West Monroe St. • Cleveland 14—616 St. Clair Ave. • Houston 2—1213 Capitol Ave. • Los Angeles 33—520 Anderson St. Miami 34—2103 Le Jeune Rd. • New York 7—50 Church St. Pittsburgh 19, Pa.—437 Grant St. • St. Louis 4—1450 S. Second St. • San Francisco 11—420 Market St. Tulsa—1640 E. 21st St.

MIDWEST . . . PIPING FABRICATORS AND CONTRACTORS FOR MORE THAN 50 YEARS

"VO"

Coen "variable orifice" metering control . . .



Coen Model 56-B Fyr-Compak oil and gas packaged burner with "VO" full metering combustion control

. . . new optional feature with Fyr-Compak®

For those who want the advantages of metering without sacrifice of firing range, Coen now offers "VO" wide-range metering control. When used with the Coen Fyr-Compak packaged burner, an 8 to 1 *practicable* firing range is guaranteed with oil, 10 to 1 with gas. In this advanced design you get:

- True *full* metering, electric or pneumatic-electric
- Instant, accurate metering of both fuel and air in a single system
- Air flow controller sensitivity to .003″ w.c.
- Both fuel metering and precise matching of fuel to air flow provided by Coen "AC" valves
- Compactness through component packaging concept
- Lowest initial cost of any nearly comparable system
- Lowest installed cost due to packaging with burner

Fyr-Compak is a completely self-contained combustion unit specifically engineered for package boiler firing. With "VO" metering, its performance is maintained at an unequalled efficiency level through years of trouble-free service. Be sure to consider Fyr-Compak for your application... it's the finest packaged burner any boiler can have.

Combustion Engineers and Manufacturers

SINCE 1912 COEN

COEN COMPANY

40 Boardman Place • San Francisco 3

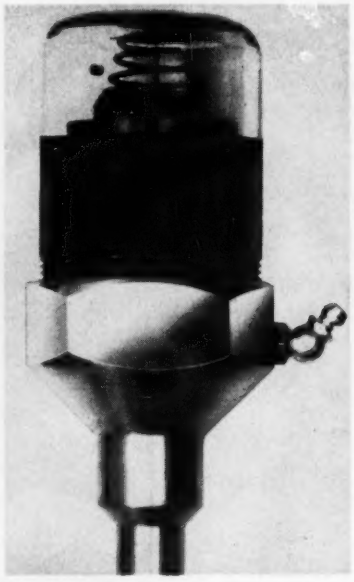
FYR-COMPAK® GAS AND OIL BURNERS; FYR-MONITOR® FLAME SAFEGUARD SYSTEMS
FUEL OIL PUMPING, HEATING & STRAINING SETS; AIR HEATERS; KILN BURNERS

Representatives in principal cities throughout the world

Equipment news

Begins on page 112

bad conditions and will maintain higher lumen output throughout the 12,000-hr life of lamp. The 450-w *BT-37* sells for $33.00; the 750-w *R-57* costs $39.50.—Duro-Test Corp



Automatic grease cup

36 • Self-feeding lubrication with visible control is possible for plain or rolling-contact bearings with these grease cups. Units feature a 4-oz reservoir; vented clear, unbreakable plastic cylinder for easy view of lube supply; spring and weighted plunger to feed grease to bearing with predetermined pressure; a protected valve that seats when cup is full.—Lubriquipment Engineers, Inc

Just circle key numbers on the Reader Service card, page 97, to get complete product story

Plastic tag protector

28 • Ordinary paper tags can now be used in place of expensive metal ones, when protected by this plastic envelope. Outdoors, the cover pro-

Why Hunter Packing Company uses STANOIL Industrial Oil

Two reasons: (1) STANOIL is a superior oil. (2) Along with STANOIL, Hunter Packing receives experienced lubrication technical service.

A special antioxidant in STANOIL gives the oil resistance to *chemical* change. Deposits are minimized. The oil has a high viscosity index, is resistant to *temperature* change. It lubricates effectively at both high and low temperatures. Due to special refining techniques, STANOIL will not readily emulsify. A special additive minimizes foaming. STANOIL has a low pour point. It flows freely at low temperatures. A rust inhibitor in STANOIL "plates out" on metal surfaces.

W. P. "Sandy" Wehking, the Standard Oil man who calls on Hunter Packing Company, has plenty of experience in technical service work. He's been at it for 17 years. Sandy studied chemistry at Blackburn College. He has also completed the Standard Oil Sales Engineering School.

To get more information about STANOIL Industrial Oil and to obtain technical help on your lubrication problems, call the Standard Oil office near you in any of the 15 Midwest or Rocky Mountain states. Or write, **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

Quick facts about
STANOIL Industrial Oil

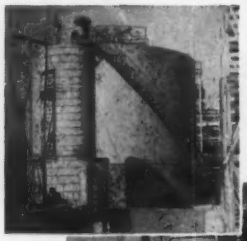
- Antioxidant gives oil resistance to chemical change, minimizes deposits.
- Inhibitor "plates out" on metal surfaces, prevents corrosion.
- Receives special refining to eliminate emulsion problems. Contains additive to minimize foaming.
- High viscosity index. Resists temperature change.

You expect more from **STANDARD** *and you get it!*

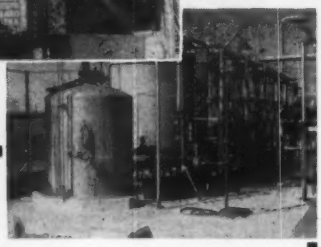
Temperature check. Frank Persson of Hunter Packing Company and Standard Oil lubrication specialist W. P. "Sandy" Wehking inspect one of four compressors in Hunter plant that uses STANOIL Industrial Oil.

WHO CHOSE H&T ?

For Boiler Feedwater Conditioning Equipment



400,000 lb. per hour fully automatic demineralizer plant with silica and CO_2 removal



These Fine Companies Did!

A Partial List of Installations

Duquesne Light Co.
Shippingport, Pa.

Yankee Atomic Electric Plant
Rowe, Mass.

Ohio-Edison Co.
Akron, Ohio

Bowaters-Carolina Corp.
Catawba, S.C.

Knolls Atomic Power Laboratory
West Milton, N. Y.

The Cleveland Elec. Illuminating Co.
Ashtabula, Ohio

Chevrolet Div. Gen. Motors Corp.
Tarrytown, N. Y.

R. J. Reynolds Tobacco Co.
Stokes County, N. C.

Tampa Electric Co.
Tampa, Florida

U. S. Gypsum Co.
Chicago, Ill.

Send for new Bulletin
50 Years of Progress

HUNGERFORD & TERRY, Inc.
CLAYTON 3 NEW JERSEY
H&T SERVICE

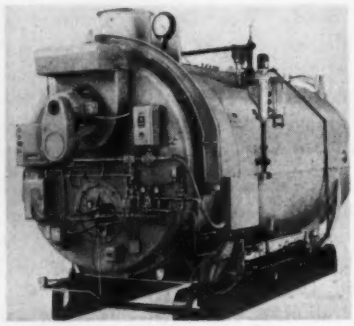
Equipment news

Begins on page 172

tects paper tag from weather, indoors it prevents soiling.

Initial cost is low, and protector is indefinitely reusable. It is available in three sizes.—Bedford Products Inc

Just circle key numbers on the Reader Service card, page 97, to get complete product story



Packaged firetube boilers

41 • Packaged-boiler line is now extended to include 400-, 500- and 600-hp units. Boilers are available for high- or low-pressure steam and can be fired with oil, gas or a combination. One feature is 4-pass forced-draft construction, said to give high flue-gas velocity and 80% efficiency and cut down tube cleaning. —Cleaver-Brooks Company

Scotch boiler burner

42 • New unit for scotch marine boilers is used where there is a known or possible backpressure or positive furnace pressure. Five standard models of the *Turbo-Flame* unit range in capacity from 1,000,000 to 5,000,000 Btu. Model *TF-1* will burn 1,000,000 Btu against .5-in.-wc backpressure, has a maximum capacity of 1,800,000 Btu with 0.1-in.-wc negative pressure.

Straight gas, oil, or combination burners are available, as well as dual-fuel gas burners. Combustion air for gas firing is supplied by low-pressure nonoverloading squirrel-cage blower. —The Mettler Company, Inc

Explosion-relief valve

27 • Crankcase explosion-relief valve is useful with heavy oil or gas engines. Units have effective flame traps to protect personnel in the area. Traps are internally oil-wet wire

CONSECO

FROM BLUEPRINT TO OPERATION

1/3 CENTURY OF EXPERIENCE

CONSECO
DESIGNS • BUILDS
ENGINEERS
DELIVERS • INSTALLS
MAINTAINS ALL

Condensing, Feedwater Heating, Evaporating, Air Removal and Condensate Cooling Equipment required in any Thermal Power Generating Plant.

CONDENSERS • EVAPORATORS
DEAERATORS • HEAT EXCHANGERS
FEEDWATER HEATERS
STEAM JET AIR EJECTORS

CONSECO SERVICE

includes the repairing, retubing, redesigning, rebuilding and testing of our own or any other make of

- Condensers
- Feed Water Heaters
- Fuel Oil Heaters
- Lube Oil Coolers
- Drain Coolers
- Evaporators
- Refrigeration Condensers
- Finned Tubing Installations
- Heaters and Coolers
- Tube Sheets
- Water Coolers

CONSECO SERVICE is as near as your telephone . . . 24 hours a day . . . 365 days a year including Sundays and holidays . . . from Maine to California. Just call Maintenance Department (see 'phone numbers below).

CONDENSER SERVICE & ENGINEERING CO., INC.

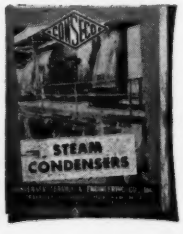
164 Observer Highway,
Hoboken, N. J.

Hoboken Telephone:
OLdfield 9-4425
N.Y.C. Telephone:
BArclay 7-0600

Send For Latest Steam Condenser Bulletin. ►

For more details consult the Chemical Engineering Catalog . . pp. 1035-1038

Bulletins on all CONSECO PRODUCTS *sent on request.*



circle 289 on Reader Service card, p 97

circle 290 on Reader Service card, p 97

IT'S NEW!

A BRAND NEW CATALOG FOR WILLIAMS VALVES

D.T. Williams VALVES GUARDIANS OF THE PIPELINES

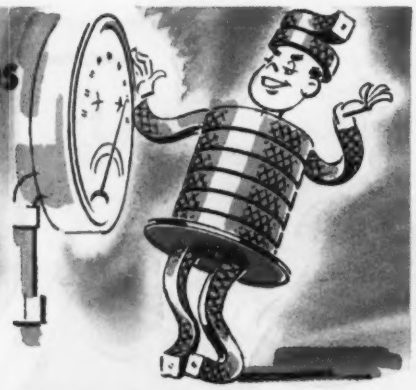
SEE YOUR
D. T. WILLIAMS DISTRIBUTOR

Next time your Williams salesman calls on you, ask him to show his new catalog which covers the complete line of D. T. Williams valves. It also includes Detroit pressure controls, temperature controls and solenoid valves.

American-Standard and Standard ® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
DETROIT CONTROLS DIVISION

Where Temperatures and Pressures "GET HIGH"



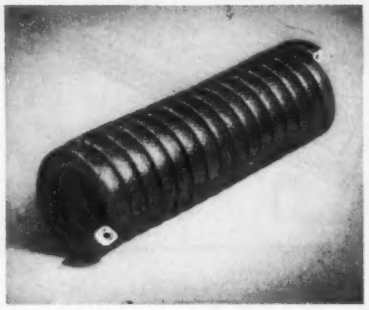
...you need these packings!

Style HP-2M – excels against severe temperatures and pressures. A braided asbestos packing reinforced with a monel wire insertion. For use on centrifugal and reciprocating pumps, valve stems, expansion joints, etc.

Style No. 30 – a very dense braided asbestos packing, highly resistant to high pressures. For use against petroleum products at high temperatures and pressures.

Style HP-RC – a wrapped asbestos cloth packing with a resilient rubber core. For use on steam hammers, expansion joints, pumps and piston rods calling for high pressure steam, air and gases at temperatures to 600 degrees F.

Style HP-RB–for high pressure steam service up to 600 degrees F. Constructed with a core of accordion-folded asbestos cloth and a resilient rubber back, around which is wrapped a closely woven asbestos cloth jacket.



Aquapak Hydraulic Packing – a semi-metallic packing designed to withstand severe hydraulic pressures. Will give satisfactory service on pressures as high as 10,000 pounds. For use against hot and cold water on centrifugal and reciprocating pumps, outside packed boiler feed pumps and similar equipment.

ALLPAX

"The Packing that Packs All"

SEND FOR OUR NEW CATALOG — TODAY!

A complete line of packing, tools, gasket materials. Ask for dealer information and price schedules.

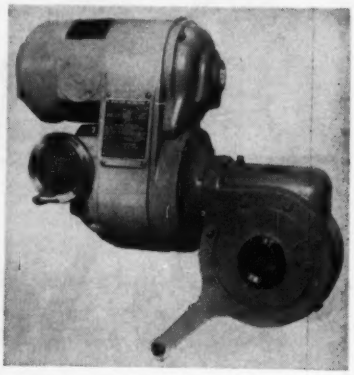
THE ALLPAX COMPANY, INC.
160 Jefferson Ave., Mamaroneck, N. Y.
CANADIAN DISTRIBUTORS: Albion Asbestos Packings Ltd., Montreal 8, Quebec

Equipment news

Begins on page 112

gauze, said to absorb more heat before allowing passage of flame because flow of hot gases is evenly distributed through the gauze layers. —The Pyropress Engineering Company Ltd

Just circle key numbers on the Reader Service card, page 97, to get complete product story



Variable-speed drive

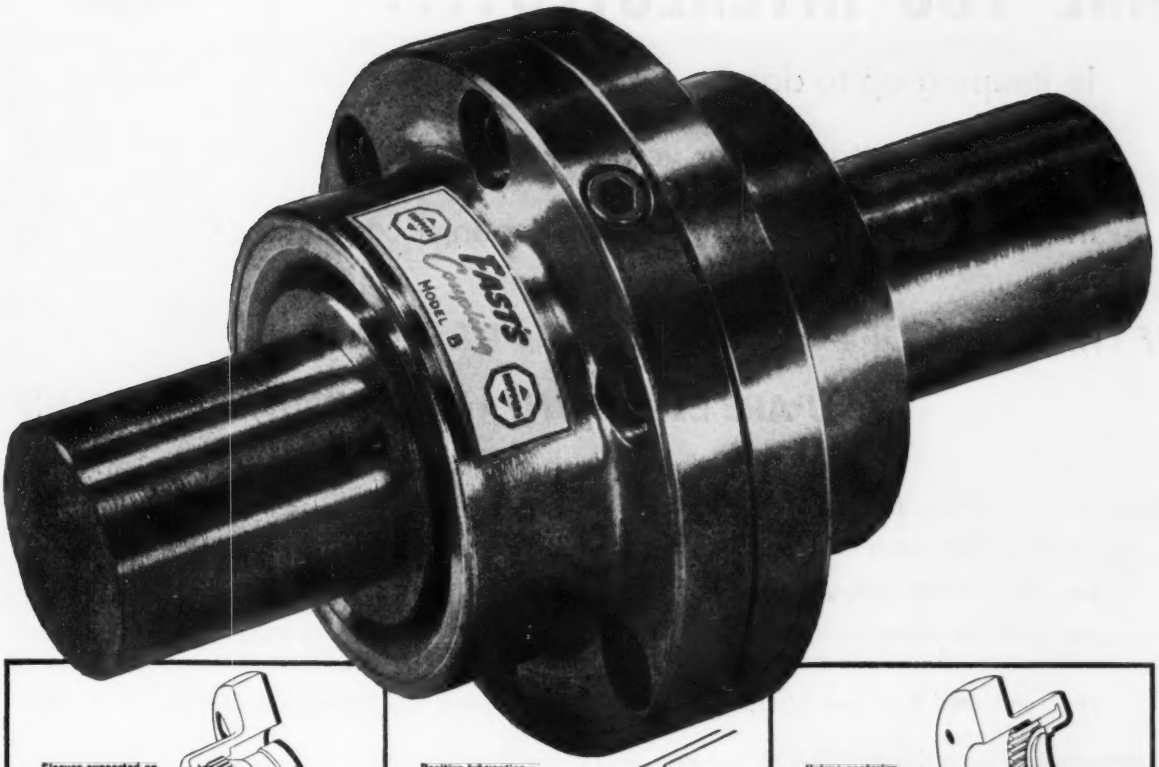
24 • Shaft-mounted mechanical unit is compact. It proves controlled speed in a light-weight space-saving power drive. Shaft mounting eliminates all intermediate transmission elements.

Drip-proof or totally enclosed constructions are available. The ¼ to 3 hp units have speeds from 360 rpm to 5.2 rpm, speed variations from 2:1 to 10:1.—Sterling Electric Motors, Inc

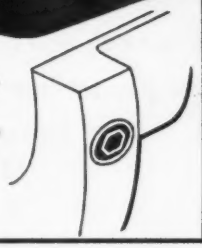
Conveyor pulley lagging

33 • Pulleys can be lagged without removal from conveyor, saving expense and downtime, according to manufacturer. A wear-, acid-, heat- and water-resistant neoprene sheet is cold-bonded to steel surface of pulley with an adhesive strength of 3700 psi.

No special tools are needed, and the lagged pulley is ready to go back to work immediately.—General Splice Corp

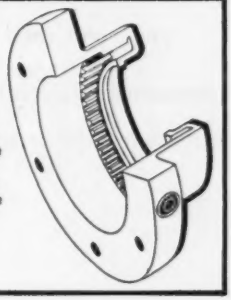


Sleeves supported on hubs. Metal end ring is dust and moisture-resistant and wear-proof. No perishable, non-metallic element is involved.



Positive lubrication— Fast's design assures continuous film of lubricant on load-carrying surfaces. Lubricant is protected from pollution by exclusive end ring design. Lube plugs in sleeve flanges afford convenient access.

Unique centering of sleeves— No crank action or vibration is possible because end rings are positively positioned on transverse center line of hub spline faces.



Fast's Model B coupling reduces downtime and upkeep for light-to-medium drives

Mechanical flexibility eliminates costly shutdowns and expensive shaft replacements. But—it's only one of many cost-saving features.

Now you can profit from the durability and economy of famous Fast's couplings in a smaller and lower-cost version—available in 5 sizes for shafts ½" to 3⅛" in diameter.

The Model B coupling gives you the same features that have made Fast's the world's leading coupling for over 35 years. You get the same trouble-free performance, longer service life and lower maintenance costs. You also get prompt delivery because stocks are on hand to meet practically every need. Free engineering service is also available.

Write today for more details to KOPPERS COMPANY, INC., Fast's Coupling Dept., 5305 Scott Street, Baltimore 3, Md.

Engineered Products
Sold with *Service*

KOPPERS

THE ORIGINAL
FAST'S Couplings

For more facts circle 293 on Reader Service card, p 97

ARE YOU INTERESTED....

in keeping up to date?

in doing a better job for your company?

in preparing for that bigger job when it comes?

IF THIS COPY OF POWER IS NOT YOUR OWN—

YOU ARE BEING UNFAIR TO YOUR AMBITIONS

Since it doesn't belong to you . . .

you can't save articles or advertisements that have a special appeal.

you can't use the postage-free Reader Service Card to get information or free literature.

you can't file copies away for future reference. And you can't use the annual index of articles because you don't have back issues.

you can't read it at your leisure (over a period of weeks, if you choose)—or at home, if you like.

A personal subscription to POWER can help you achieve your goals.

Your own 3 year subscription costs you so little.

36 idea-packed issues including:

15 Famous Power Special Handbook Reports

21 Today's Development Reports

3 Annual Indices of Articles by Subject Matter

Simply fill out the postage-free card enclosed in this issue and drop it in the nearest mailbox. We'll bill you later.

POWER—Subscription Manager 5-9
330 West 42nd Street (Please check only one)
New York 36, N. Y. ☐ X-37 ☐ X-49 ☐ X-48 ☐ X-50

Please enter my subscription to POWER for 3 years (36 issues) for $10 (U.S. & U.S. Possessions Only). Since I am enclosing payment please send me the free handbook checked above. (I prefer 1 year at $5 for U.S. subscribers, including free book, ☐)

Name..... Title.....

Address ☐ Home .....
☐ Business .....

City..... Zone..... State.....

Company..... Number of Employees.....

Major Product or Service.....

(Canada $14 for 3 years—All other foreign $40 for 3 years)

OR

If you use this coupon and save us the cost of billing by enclosing your check or money-order (made out to McGraw-Hill Publishing Company), we'll send you *free of additional charge* your choice of ONE of these free books—

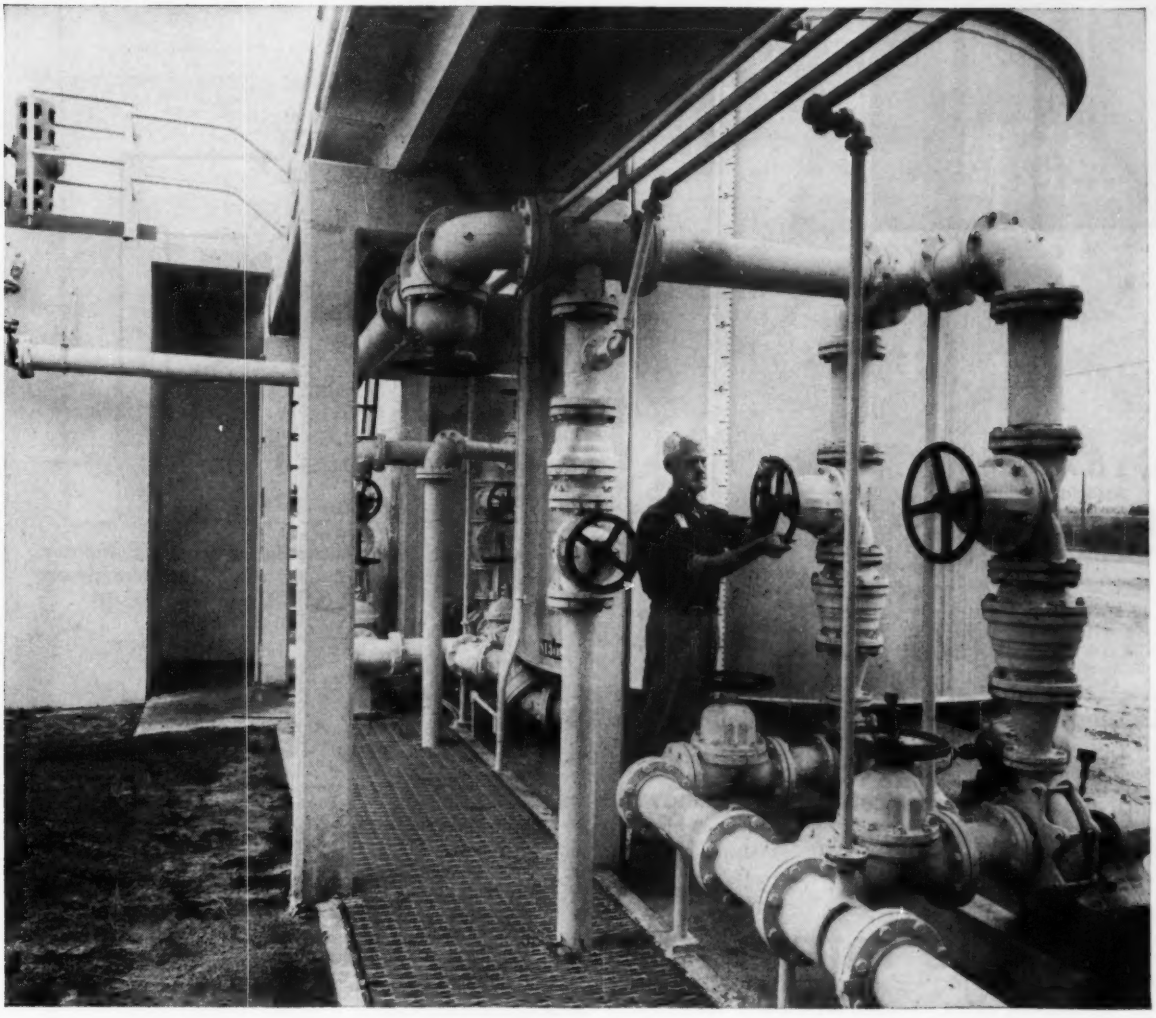
X-37 POWER Handbook (Parts I & II)

X-48 Manual of Practical Engineering Data

X-49 Library of Practical Power Generation (Boilers, Turbines, Diesels)

X-50 Practical Power Service Library (Pumps, Motors, Fuels)

DOW | **SARAN LINED PIPE**



After 9,000,000 gallons of heated acids, plating waste ... No Corrosion in **SARAN LINED PIPE**

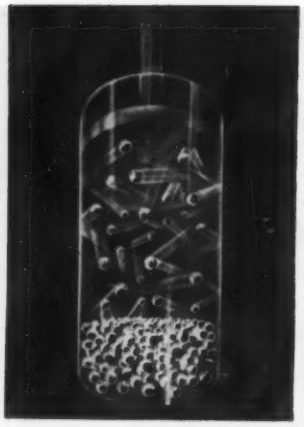
When piping and valves carry more than a million gallons a month of heated acid and plating waste solution . . . when failure in the line would peril essential plant operations . . . there can be no guessing about corrosion resistance. The situation calls for Saran Lined Pipe and valves!

Shown above is one of the Saran Lined Pipe installations in use at the Florida R & D Center, Pratt & Whitney Aircraft, Division of United Aircraft Corporation, United, Florida. This installation carries 1,100,000 gallons per month of solutions of chromic acid, hydrogen fluoride, potassium cyanide, nitric acid, phosphoric acid and other chemicals. The solutions are in transfer from the Plating Department to waste treatment areas, at an average temperature of 100°F.

The Saran Lined Pipe and valves were installed eight months ago. Thanks to the extreme corrosion resistance and high mechanical strength of the piping, there's not been a single trace of corrosion or of failure.

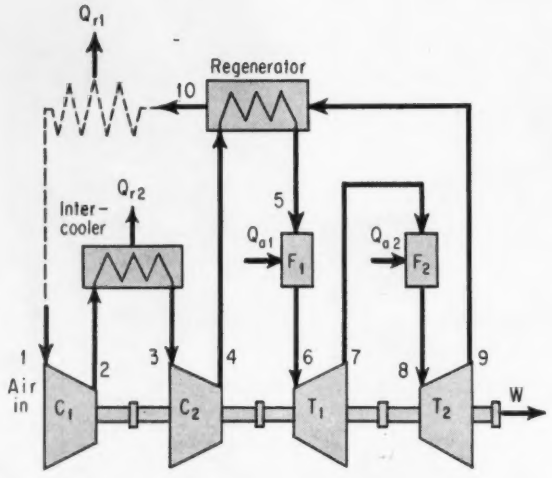
Whenever problems of corrosion and chemical activity are encountered in piping systems, Saran Lined Pipe is your best answer. Saran Lined Pipe, fittings, valves and pumps are available for systems operating from vacuum to 300 psi, from below zero to 200°F. They can be cut, fitted and modified in the field. For information, write Saran Lined Pipe Company, 2415 Burdette Ave., Ferndale, Michigan, Dept. 2289DW5.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN



THERMO REFRESHER NO. 27

By B G A SKROTZKI
Associate Editor



1 Regenerative cycle with intercooling and reheating gives most opportunity for raising efficiency at cost of more equipment

Our most recently developed prime mover—the gas turbine—proves to be a versatile machine. It can be arranged in many ways to improve its performance. Let's study how we can do this by . . .

Cycle intercooling and reheating

Last month we took a close look at the parts of a gas-turbine cycle and learned what made them tick. We studied both the simple and the regenerative ideal cycles. Now let's go one step further and look at the "ultimate" cycle using intercooling and reheating, Fig. 1.

Intercooling. Here we use the regenerative-cycle arrangement but split the compressor into two parts and insert an intercooler. This cools the partly pressurized air back to atmospheric at state *1*, before completing compression to the top pressure at *4* and sending air to regenerator.

Reheating. We split the turbine in two parts, letting the hot gas expand partly in the first section. Then we reheat the partly expanded gas in a second combustor F_2 back to initial temperature so $T_6 = T_8$. The low-pressure gas then completes its expansion to atmospheric at *9*.

Heat transfer. If we again assume this as an equivalent closed air-standard cycle we can apply the First Law and write:

$$W + Q_{r1} + Q_{r2} = Q_{a1} + Q_{a2} \quad (1)$$

and so

$$W = (Q_{a1} + Q_{a2}) - (Q_{r1} + Q_{r2}) \quad (2)$$

In effect this cycle splits the heat additions and rejections into two parts compared to the simple cycle, see Part 26, April 1959. Fig. 2 shows the T-S graph for this cycle under ideal conditions. In this graph the states correspond to the points in Fig. 1.

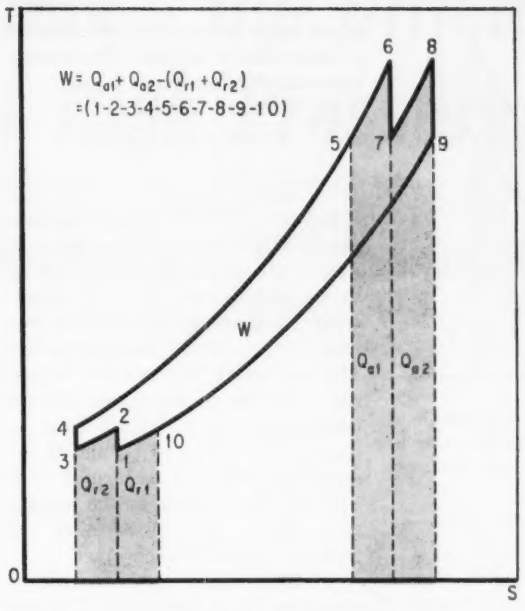
According to equation (2) the net area of the cycle loop W is the net work output of the cycle. We can show this in Fig. 2 by remembering that the total area under *9-10* is the heat given up by the turbine exhaust in the regenerator, Q_t. This heat transfers to the pressurized air and equals the area under process *4-5*. Then:

$$W = Q_t + Q_{a1} + Q_{a2} - (Q_t + Q_{r1} + Q_{r2})$$

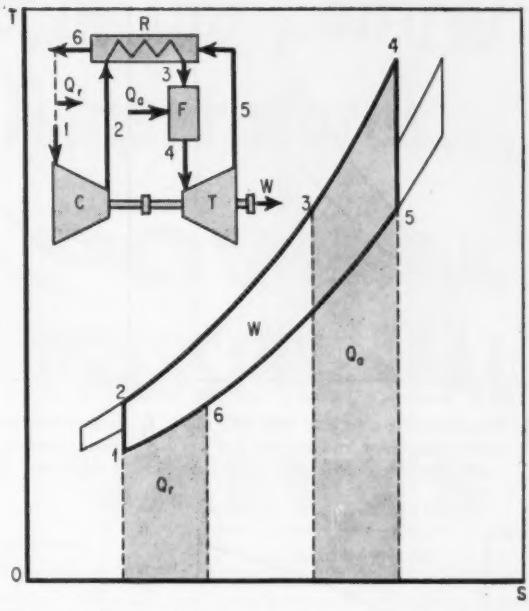
Cancelling Q_t's gives us equation (2).

To understand what the intercooling and reheating does for the cycle we have to refer back to the basic regenerative cycle, Fig. 3. Here we do all the compressing in one step or process *1-2* and all the expansion in one process *4-5* instead of breaking them up as we have done in Fig. 2.

The net loop W measures the work



2 Ideal intercooled and reheated regenerative cycle receives heat input at highest average temperature, rejects at lowest



3 Regenerative cycle has lower work output and thermal efficiency when not using intercooling and reheating of Fig. 2

output of the cycle and, of course, $W = Q_a - Q_r$. Remember that heat transferred in regenerator Q_t equals the areas under *2-3* and *5-6*. This cycle has the same pressure ratio, compressor-inlet state and turbine-inlet temperature as the cycle of Fig. 2, yet it has a lower overall thermal efficiency. The W output is less by the two "ears" shown on each end of the cycle. But most significantly the average temperature of heat addition during *3-4* is lower than the heat addition during *5-6*, *7-8* of Fig. 2.

At the other end of the cycle we find a like comparison. The average temperature of heat rejection during *6-1* in Fig. 3 is higher than the average during *10-1*, *2-3* of Fig. 2. So we see that intercooling lowers the average temperature of heat rejection, and reheating raises the average temperature of heat addition to raise the overall cycle thermal efficiency, in accordance with the basic Carnot principles.

Actual cycles. Studying ideal cycles always helps to separate effects of fundamental arrangements. This we have done, now let's study the effects of actual machines in the gas-turbine cycle.

Fig. 4 shows the T-S graph for a simple-cycle gas turbine. Process *1-2* is the irreversible compression of the incoming air in a compressor working at 80% efficiency. Process *2-3* is the constant-pressure heating in the combustor. Process *3-4* is the irreversible expansion of the heated pressurized air in the turbine at 80% efficiency. Process *4-1* is the constant-pressure heat rejection to the atmosphere between turbine exhaust and compressor air inlet.

This does not show all the irreversibilities possible. Others that can be important would be pressure drops between atmosphere and compressor first stage, between compressor last stage and combustor, in the combustor, between combustor and turbine first stage, between turbine last stage and atmosphere. Radiation from all parts of the cycle would also lower efficiency. But let's keep this simple and just study the most important effects—efficiency of the compressor and the turbine.

We define compressor efficiency e_c as:

$$e_c = \frac{\text{Ideal work}}{\text{Actual work}} = \frac{(h_1 - h_2)_s}{h_1 - h_2} \quad (3)$$

This shows that the actual compressor work is more than the ideal at constant entropy. The irreversibility, of course, makes the entropy increase at state *2* in Fig. 4. We draw the process *1-2* dotted because no heat is transferred during the adiabatic compression and area below has no meaning.

We assume during the heating *2-3* that the pressure stays constant and the process is reversible. So the total gray area under the process measures the heat added to the cycle, Q_a.

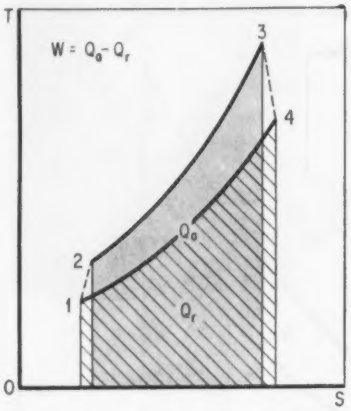
We define turbine efficiency e_t as:

$$e_t = \frac{\text{Actual work}}{\text{Ideal work}} = \frac{h_3 - h_4}{(h_3 - h_4)_s} \quad (4)$$

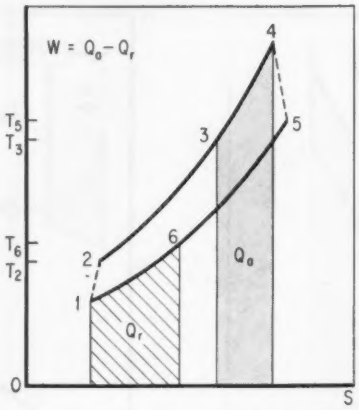
During its irreversible adiabatic expansion the gas entropy increases in the turbine. Again because the area under the process has no meaning we draw the process dotted.

During the constant-pressure cooling *1-4* the cycle rejects the unusable heat Q_r to atmosphere. Even for an irreversible cycle the First Law applies and $W = Q_a - Q_r$. The net work is the difference of the shaded and cross-hatched areas. But these areas are not coincident so no net area measures W. Note that the loop of processes *1-2-3-4* does *not* measure W. This always holds true when we have irreversible processes in a cycle.

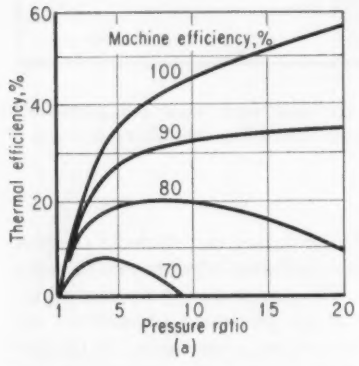
In Fig. 4 the less efficient the compressor and turbine the greater the increase in the gas entropy changes. The units can become so inefficient that Q_r will equal Q_a and make $W = 0$. On the graph this would show by Q_a becoming narrower and Q_r

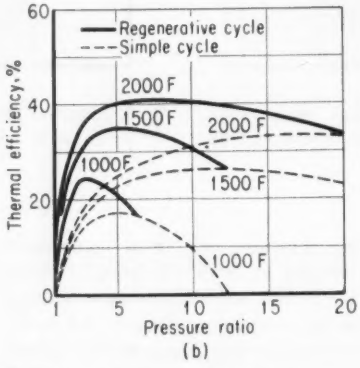


4 Simple-cycle gas turbine with 80% efficient compressor and turbine has net work output less than net area of loop



5 Regenerator improves actual gas-turbine performance even though there must be temperature drops in heat exchanger





6 (a) Compressor, turbine efficiencies, pressure ratios control simple-cycle thermal efficiency. (b) Turbine inlet temperature, pressure ratio control efficiency

becoming wider as efficiencies drop.

Cycle efficiency. Fig. 6*a* shows the variation in simple-cycle thermal efficiency with machine efficiency. By machine efficiency we mean that for the 90% curve, both compressor and turbine efficiency are each 90%, and so on. Last month we learned that the ideal simple-cycle efficiency depended only on the overall pressure ratio—the 100% curve defines this relation.

For irreversible cycles the machine efficiencies, air-inlet temperature and turbine-inlet temperature have marked effect on cycle efficiency. In Fig. 6*a* the curves apply to a cycle with 60-F air inlet, 1500-F turbine inlet, 100% combustion efficiency and no pressure losses in the cycle. Practical machine efficiencies lie in the range of 80 to 90%. The curves show that cycle efficiency peaks at a certain pressure ratio; the optimum pressure ratio drops as the machine efficiency drops. When machine efficiency drops to 60% for these conditions the cycle cannot even run itself because of the irreversible losses.

In contrast the 100% curve has no peak but continues rising and is asymptotic to the Carnot cycle efficiency, the ideal for the cycle.

Regenerative cycle. Fig. 5 shows the T-S graph for a practical cycle layout as shown in Fig. 3. The cycle T-S loop is a duplicate of that for the simple cycle as in Fig. 4, but the regenerator fixes certain states during the heating and cooling processes that affect cycle efficiency.

In an ideal regenerator $T_3 = T_5$ and $T_2 = T_6$ but since an actual heat transfer needs a temperature difference we find $T_3 < T_5$ and $T_2 < T_6$. The degree to which these temperatures can be made equal in a regenerator is measured by its effectiveness which depends largely on the amount of heat-transfer surface. We measure regenerator effectiveness e_r as:

$$e_r = \frac{\text{Actual heat transfer}}{\text{Potential heat transfer}} = \frac{c_p(T_3 - T_2)}{c_p(T_5 - T_2)} \qquad (5)$$

Regardless of the actual effectiveness, the heat absorbed by the pressurized air equals the heat given up by the turbine exhaust in the regenerator. This means then that the area under *2-3* equals the area under *5-6*. The area under the latter will be narrower because of the higher average temperature. As the effectiveness decreases, the widths of Q_a and Q_r increase showing that the overall cycle efficiency drops, because the average temperatures of heat addition and rejection approach each other.

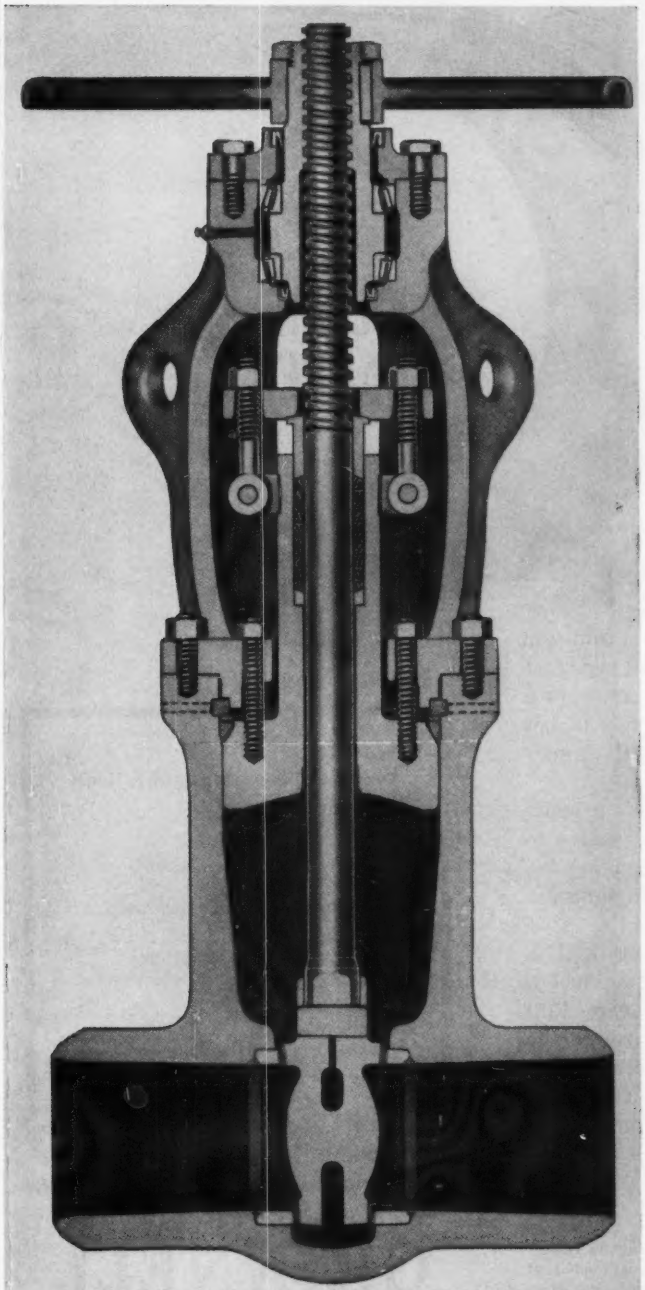
Turbine temperatures. Fig 6*b* compares the performance of simple and regenerative cycles at three turbine-inlet temperatures—1000, 1500 and 2000 F. These cycles are based on 60-F inlet air, 85% machine efficiencies, 70% regenerator effectiveness, 100% combustion efficiency and no pressure losses.

Each of the simple and regenerative cycles has an optimum pressure ratio for each turbine temperature. The regenerative cycles are more efficient than the simple cycles at the same turbine temperatures, and at markedly lower pressure ratios. As we might expect, rising turbine temperature improves cycle thermal efficiency. Metallurgical limitations keep most practical temperatures below 1500 F in our modern gas turbines, but these curves show why designers make continuing efforts to find ways of using the highest possible temperature by introducing a variety of blade and bucket cooling methods.

Each of the regenerative curves in Fig. 6*b* intersects the simple-cycle curves at some pressure ratio. As pressure ratio rises the compressor discharge temperature T_2 in Fig. 5 approaches turbine discharge temperature T_5. With a high enough pressure ratio T_2 will exceed T_5. Then the turbine exhaust would cool the compressor exhaust in the regenerator instead of heating it. This, of course, lowers the efficiency below that of the simple cycle.

Next part will deal with compressor and turbine nozzles and buckets.

Here's the Ultimate in the Control of High Pressures, Temperatures...



Sectional view of 1500-pound Steel Pressure Seal Gate Valve. 600, 900 and 2500-pound valves are also available—in all commercial sizes.

Steel Pressure Seal Globe, Angle, and Check Valves are also included in the complete Powell Line.

POWELL PRESSURE SEAL VALVES

When Powell Steel Pressure Seal Valves are specified and installed on high pressure, high temperature lines you can be sure of top performance in controlling the flow of the fluids being handled.

Superior features of design and construction, many found only in Powell Valves, make this possible. For example:

- Sturdy studs hold the yoke to the body, eliminating the need of a heavy clamp, and maintaining perfect alignment and rigidity of yoke to the body.
- Stellite faced pack-under-pressure seat and stem guide insure tight sealing and accurate guiding of stem.
- Lifting lugs in yoke facilitate handling the valve during erection and maintenance, and provide means for supporting weight of the valve.
- The gasket can be removed without damaging the sealing surface of the body. The gasket seating surface in the body can be easily lapped, if required—an outstanding feature of Powell design.

These are a few of Powell proven features. There are others we'd like to tell you about. Write—or consult your nearby Powell distributor.

THE WM. POWELL COMPANY
Dependable Valves since 1846
Cincinnati 22, Ohio

BRONZE • IRON • STEEL
CORROSION RESISTANT METALS AND ALLOYS

POWELL ...world's largest family of valves

For more facts circle 295 on Reader Service card, p 97

New addition to the line of Grinnell malleable iron hangers

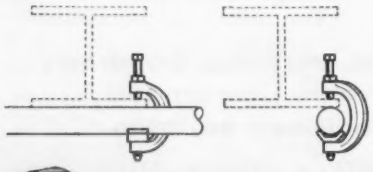
Grinnell's Malleable Iron G Clamp Hanger is a new addition to the line of Grinnell Pipe Hangers and Supports, the most complete line of any manufacturer. This hanger answers a long-felt need for support of pipe or conduit (up to 4 inches in size) where application can be made directly under structural steel.

The saddle of the Grinnell G Clamp swivels. This permits pipe or conduit to be installed either parallel or traverse to the beam axis. Separate beam clamp, rod and pipe clamp are not required, thus saving cost of supports and installation time.

Grinnell G Clamps are made of malleable iron with a ribbed design for added strength. The set screw has a hardened steel cup point for clamping rigidly to beam. Full thread engagement is provided by the tapping through the upper jaw. Approved by Factory Mutual Laboratories for use on fire protection and plumbing systems. Especially recommended for hanging conduit. Maximum recommended loads are from 210 to 450 pounds, for the smallest to the largest sizes, with a safety factor of 5.

Every Grinnell Malleable Iron Hanger offers . . .

- Safety factor of at least 5
- Thickness of metal increased at points of concentrated stress
- Homogeneous metal composition throughout
- Extremely high resistance to impact and corrosion
- Economy



Saddle swivels, permitting suspension of the pipe or conduit at any angle in a plane parallel to the face of the supporting flange.

GRINNELL
AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPLIES

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

For more facts circle 296 on Reader Service card, p 97 circle 297 on Reader Service card, p 97 ➤

6 Ljungstroms® go to work for the city of Memphis ...and so does lifetime Air Preheater service

The City of Memphis Light, Gas and Water Division has just installed three boilers served by six Ljungstrom preheaters. Why Ljungstrom preheaters? One reason is service. Air Preheater engineers don't just wait for a call. They regularly inspect and help maintain Ljungstroms *through the life of each unit.*

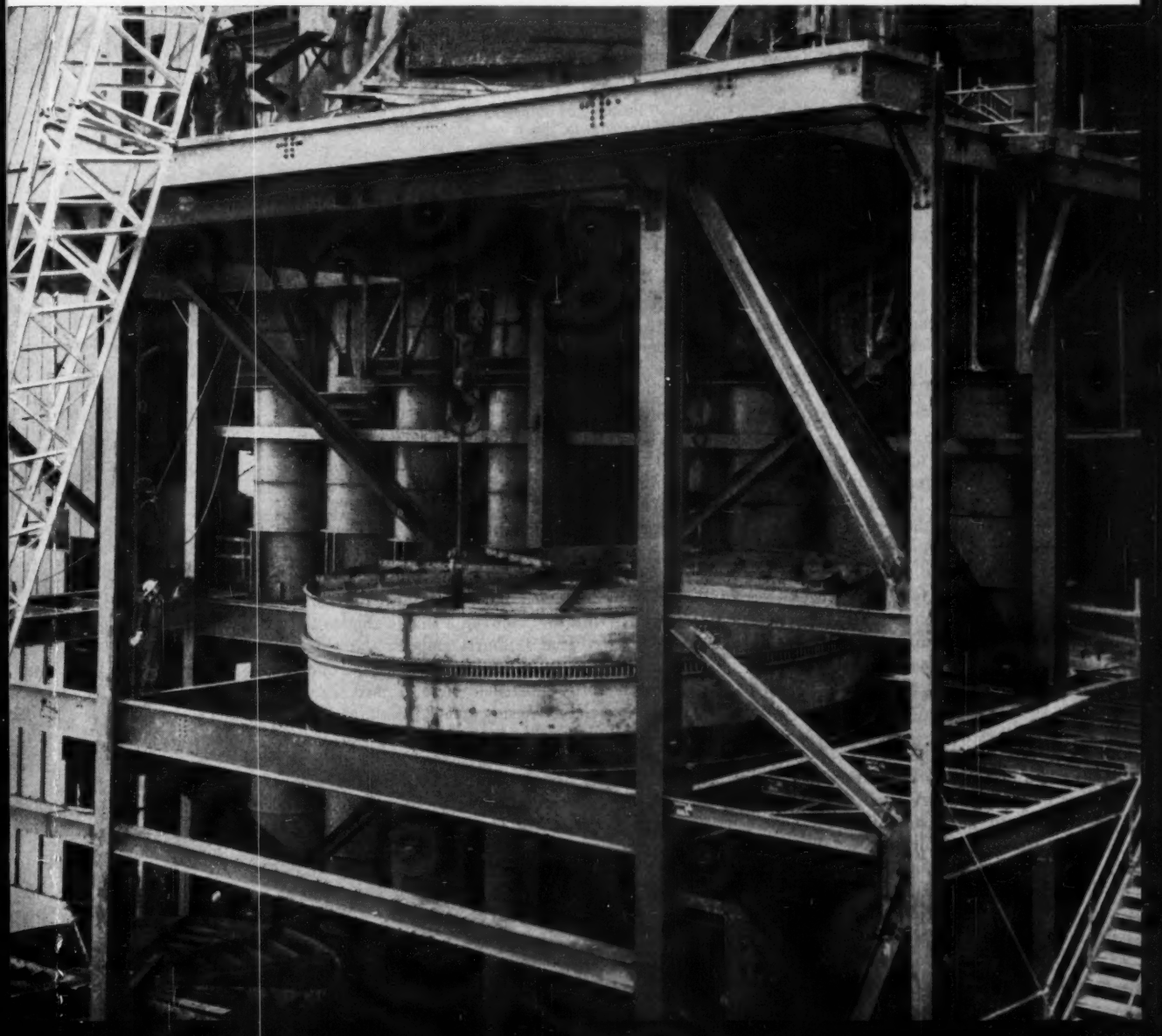
What's more, Air Preheater provides rapid *factory* service in an emergency. Here's an example. A customer phoned on a Friday morning for a replacement trunnion—a major integral part of the preheaters. His Ljungstrom was 17 years old, which meant that a new trunnion had to be custom made to match his older-style. He was located 500 miles away. And he needed his boiler back on the line by Sunday.

Air Preheater went to work. Special trucking was arranged. The job was done *and shipped* that same evening. The customer had the trunnion by Saturday morning and the boiler was back on the line by Saturday evening!

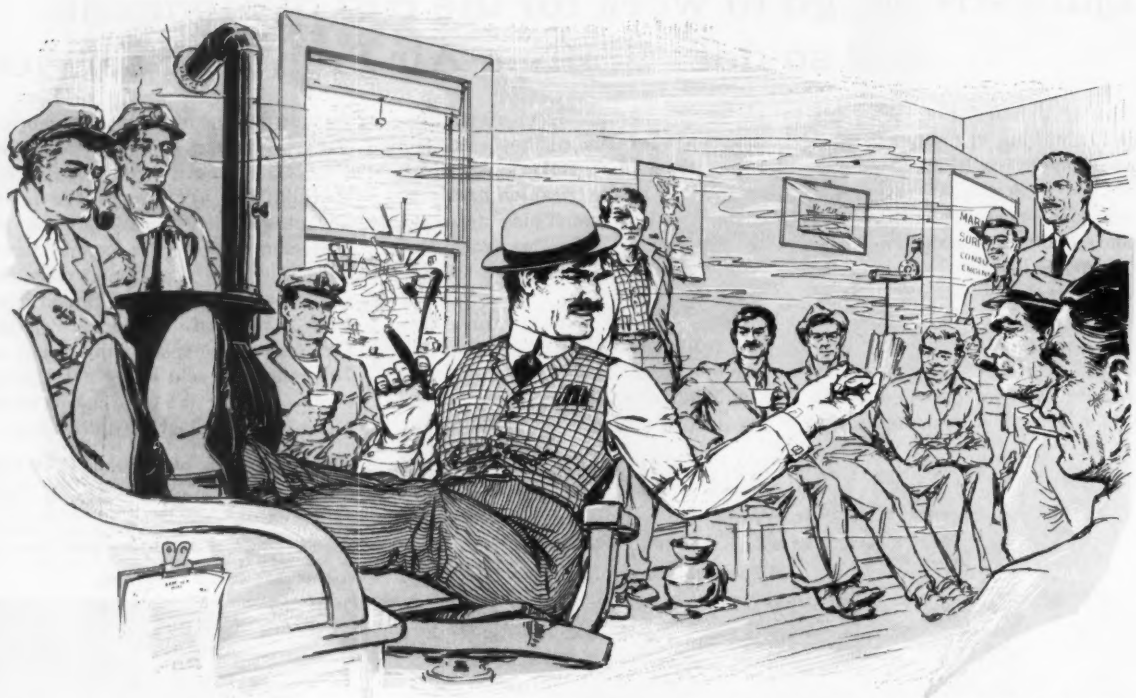
Fast response to emergencies and regular inspection of Ljungstrom installations are two of the many advantages Air Preheater provides its customers. Another is expert knowledge of boiler and preheater problems—and how to lick them—gained from over 35 years of experience. Perhaps these reasons explain why 9 out of 10 preheaters sold today are Ljungstroms. For further information write today for free illustrated brochure.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.



Ljungstrom rotor being installed for the City of Memphis Light, Gas and Water Division. Six such Ljungstroms—each with 201,400 sq ft of heating surface—will serve three boilers. The boilers will each evaporate 2,000,000 lbs of steam/hr and have a combined nameplate capacity of 750,000 kw. A fourth boiler unit is now under consideration. Burns and Roe, Inc. designed and supervised construction.



"BILGEWATER on paying a bonus for saving fuel," scoffed Marmaduke Surfaceblow to the crowd of waterfront characters gathered in his office

Marmy's bogus bonus

Still shaking after putting my 24-page special report on *Vibration detection and balancing* to bed, I meandered over toward the Bent Propeller Bar to look up Marmaduke Surfaceblow. Passing O'Houlihan's Machine Shop & Engine Works, I decided to go up and see if the old consultant was in his office.

As I climbed the creaky wooden steps leading to the second floor, the slapping of leather belts and familiar machine shop noises from down below made music in my ears. But when I hit the second floor I was rudely brought back from daydreaming about my own shop days.

Marmy's bright red door was open and a pea-soup haze of smoke was rolling out. It smelled as if a mixture of old rubber boots and autumn leaves was burning inside. And the loud arguing and guffaws from inside were enough to bust a guy's eardrums.

Poking my nose into that No. 4 Ringelmann smoke-filled room started me coughing violently. When the tears finally stopped running down my cheeks, I took a deep breath and barged inside. Marmy was at his tired old roll-top desk, working away and puffing on a black piece of rope yarn. A dozen waterfront characters were crowded into his room, drinking coffee, smoking and giving each other a lot of back talk.

"One way to cut down on fuel consumption is to give the boys a bonus," said Fred McFid, the tough looking ex-chief who was wearing a bandage over his left eye.

"That's funny as hell," chimed in Art Cannon, from his vantage point near the pot-bellied stove with the ancient coffee pot perking away on top. "I always get a laugh when I hear that argument come up."

"Oh!" cut in Sam Wilcox, the scrappy little tugboat engineer. "I always said . . ." but that's as far as Sam got.

"BILGEWATER on a bonus for saving fuel," suddenly roared Marmy, as he revved up his draft inducer and exhausted a huge cloud of eye-watering smoke towards the ceiling. That sudden blast closed every last one of the yapping traps in the room. "I'll tell you guys how one plant started paying a bonus so they'd burn less fuel, but soon stopped it for the same reason," continued Marmy, blowing a smoke ring to the ceiling.

That outburst stopped the chatter for good, but not the smoke. So I stood near the door where I could almost breathe normally and listened. Leaning back in his swivel chair, Marmy hoisted his No. 16 canal boats up on his desk. Giving his battered gray bowler a starboard list, he blasted away again in his foghorn voice.

"Back in 1929 I was master mechanic in a large Indianapolis brewery. The plant had burned oil for a few years, but converted back to coal when they got a new plant engineer. He was full of efficiency ideas—some good, some not so good. First off he made a chief out of one of the watch engineers, then he decided to put an extra fireman on each shift.

continued

SAFETY IN THE RIGHT PERSPECTIVE

with Flexitallic Spiral-Wound Gaskets

In this enlarged sectional view, you can see the Spiral-Wound Gasket construction originated by Flexitallic in 1912. And you can see Flexitallic Blue, the blue dye in the Canadian asbestos filler, which is the mark of an engineered Flexitallic Gasket.

Flexitallic means sealing at its safest. You get performance you can depend on throughout all pressure/temperature ratings, because the compression characteristics of the gasket are always related to the pressure/temperature ratings of the flanges with which they are assembled.

When fluids are confined in a critical pressure/temperature range . . . when flanged joints are subject to thermal and mechanical shock, vibration, weaving, and other joint stresses . . . engineers demand the maximum in gasket performance.

That's why they specify Flexitallic Spiral-Wound Gaskets.

FLEXITALLIC GASKET CO.
8th & Bailey Sts. Camden 2, N.J.

Flexitallic®
SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Flexitallic is a registered tradename. No one else can make a Flexitallic Gasket. Look for *Flexitallic Blue* — it's our exclusive blue-dyed Canadian asbestos filler.

SAFE
DEPENDABLE
GENERATOR
OPERATION

Spark Free!
EXPLOSION
RESISTANT

Adaptable
To Any
Industrial
Engine!

Kato's complete line of 50, 60 and 400 cycle revolving field AC Generators is now available in brushless design.
Especially desirable for operation in gaseous environments.

★ GREATLY REDUCED MAINTENANCE!

KATO BRUSHLESS AC GENERATORS

60 CYCLE SIZES
3 Phase: 5 to 400 KW
1 Phase: 5 to 150 KW

SPEEDS
720. 900. 1200. 1800 RPM.

Take your choice throughout the Kato Line — Brushless or standard slip ring types. For all your 400 cycle or power converting needs, investigate Kato's complete line of high frequency alternators and motor generator sets. Complete control systems for all Kato products include Kato magnetic amplifiers, voltage regulators, static exciters and motor starters for synchronous or induction motors.

BUILDERS OF FINE ROTATING ELECTRICAL MACHINERY SINCE 1928

NEW BRUSHLESS GENERATOR CATALOG
Write For It Today!

KATO ENGINEERING COMPANY
1479 FIRST AVENUE, MANKATO, MINNESOTA — PHONE 8-2941

For more facts circle 299 on Reader Service card, p 97

WHY YOU GET MORE WHEN YOU BUY VIKING ROTARY PUMPS

COMPLETE SELECTION

In many cases, you can quickly order the pump you need. Why? Because you can select from over 750 catalogued models and thousands of specials . . . in sizes from 2/3 to 1050 gallons per minute. You save time and money buying from this one **complete** source!

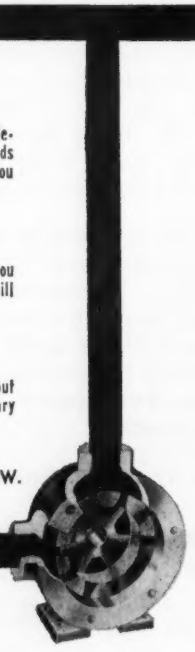
TOP QUALITY

Every Viking Pump has quality built into it — quality that will save you many repair bills. Ask the service man how he rates Viking. You will find they have top rating.

ROTARY PUMP "KNOW-HOW"

Engineers at Viking apply and think rotary pumps and **nothing** but rotary pumps. From them, you can get the best information on rotary pump applications . . . no half-way measures at Viking.

Send today for our 8-page folder on Viking Pumps . . . 59SW.



VIKING PUMP COMPANY
Cedar Falls, Iowa, U. S. A. In Canada, it's "ROTO-KING" pumps

See Our Catalog in Sweet's Industrial Construction and Plant Engineer's File

Marmaduke

Continued from page 150

"The new chief was a swell egg and mighty proud of his new title. He was so eager to make good that he sold the new plant engineer on a bonus system. His idea was to pay an extra dime an hour to the fireman who showed the best steaming efficiency for the week. That would amount to $5.20 every seven days.

"At the end of the first week Glen Spooner won the bonus. That surprised everyone because he had the least amount of coal-burning experience. But next week he won again; also the next and the next. He not only won each week, but he generated so much more steam than his buddies that the new chief had to work overtime to recheck his own figures.

"At the end of four weeks the new plant manager called Glen into his office and congratulated him on his fine work. That didn't set well with the other firemen. Some of them had burned coal for years and considered themselves mighty hot stuff with a slice bar and coal shovel.

"They accused Glen of gypping them with the scale when he weighed his coal. To end that argument, the chief put a padlock on the scale. He gave the key to the watch engineer who opened it each time the hopper had to be filled. But that week Glen won the bonus again. That was too much for the other firemen to swallow quietly.

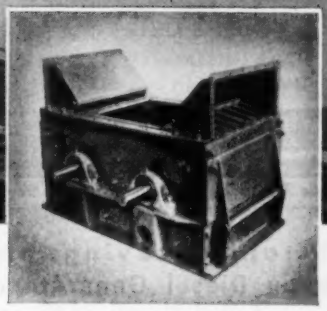
"They accused Glen's watch engineer of being in cahoots with him. After some fisticuffs and a few black eyes, the new chief said he'd soon put a stop to any monkey business. So he changed the shifts. The engineers were rotated clockwise and the firemen counterclockwise. 'Now we'll see *who* knows *what* about firing coal.' he said, winking slyly at the plant manager. But who do you think won the bonus after the change? Glen, of course.

"It made no matter to Glen which engineer was on watch, he still copped the bonus. But instead of becoming the plant's fair-haired boy, everyone from the plant manager on down started eyeing Glen suspiciously. They studied his method of firing, if you could call it a method. But no one could notice anything spectacular in the way he sliced and raked his fires.

continued

For more facts circle 300 on Reader Service card, p 97

STEPHENS-ADAMSON

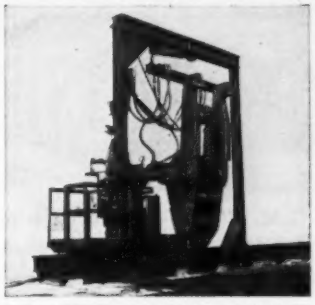


S-A RING TYPE, DOUBLE ROTOR KNITTEL CRUSHER — Crushes lumps while in suspension. Maintains full capacity with wet coal — no clogging. Greater capacity — less space required.

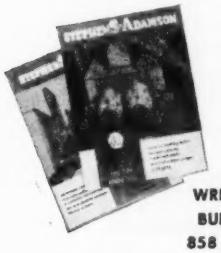
COAL HANDLING SYSTEMS
increase tonnage, lower costs!

When STEPHENS-ADAMSON engineers and builds a coal handling system, over a half-century of "know-how" in the design of unloading, storing, crushing, reclaiming, sampling, and distributing systems is put to use. S-A experience dates back as far as the early beginnings of electric power and includes the engineering of giant systems such as the mammoth Detroit-Edison and New York State Electric installations to a newly engineered power plant in Bombay, India. Large or small, an S-A engineered system means more kilowatts per ton and years of dependable service.

Backing up the "know-how" and experience is a quality-engineered line of components, each providing an exclusive combination of features — many of them carrying patents by S-A engineers. Put S-A engineering skill to work for you . . . write for full information today!



S-A HYDRAULICALLY POWERED CARQUAKE — Maximum efficiency in unloading hopper cars with minimum noise. One man operation. No expensive overhead structures — a completely self-contained unit.



WRITE FOR BULLETINS 858 and 658

S-A

MATERIALS HANDLING PRODUCTS

ENGINEERING DIVISION
STEPHENS-ADAMSON MFG. CO.
GENERAL OFFICE & MAIN PLANT, 5 RIDGEWAY AVENUE, AURORA, ILLINOIS
PLANTS LOCATED IN: LOS ANGELES, CALIFORNIA • CLARKSDALE, MISSISSIPPI
BELLEVILLE, ONTARIO

For more facts circle 301 on Reader Service card, p 97

Snapit-On

Protector Shields for CONDENSER AND BOILER TUBES

DETERS EROSION

PREVENTS MATERIAL WASTAGE

REDUCES MAINTENANCE

GIVES TUBES LONGER LIFE

MADE IN STAINLESS STEEL AVAILABLE IN ALL SIZES

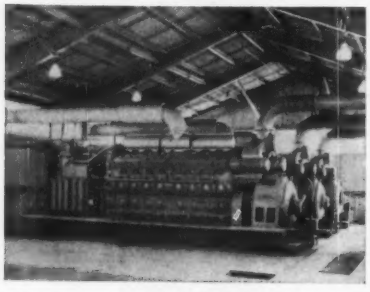
The Vince BASNIK COMPANY

2020 LINDEN STREET • CLEVELAND 14, OHIO

circle 302 on Reader Service card, p 97

(Advertisement)

Substantial savings on turnkey Diesel Generators at nuclear fuels plant



New G.M. Electro-Motive Division 3000/5000kw dual fuel power plants in turnkey installation at Kermac Nuclear Fuels Corp., Grants, New Mexico, are typical of the reliable 500kw, 750kw and 1000kw AGSCO-engineered diesel generating units available from stock at substantial savings to you.

Write for details

A. G. SCHOONMAKER CO., INC.

Foot of Spring St., Sausalito, Calif.
EDgewater 2-1490

50 Church St., New York 7, N. Y.
Digby 9-4350

Marmaduke

Continued from page 152

At least not enough of a difference to keep putting him into the chips week after week. If anything, Glen seemed to take it easier than anyone else and the stack seemed to belch more smoke on his watch. Yet, he always picked up the marbles at the week's end.

"This went on for three months. By then the boys were sore as a broiled lobster. But Glen would only gloat and go away whistling happy tunes when his buddies made snide remarks. Or, to really rile the other firemen, he'd take out a handful of one dollar bills and start counting them. They all felt that some kind of sleight-of-hand was going on, but no one knew exactly what.

"Then it happened. One evening the chief returned to the power plant after a front office meeting. His visit was totally unexpected for he'd never showed up at that hour before. What he found surprised him as much as it did Glen.

"As the chief rounded No. 4 boiler, he spied Glen holding up the pawl of the boiler meter's integrator cam. The watch engineer was busy making a routine check of the big corliss steam engine driving the large upright ammonia compressor.

"On that job pounds of steam generated totalled the integrator reading times 450. So Glen generated a lot of steam, and all in a few seconds. He did it not by sweating with his slice bar, but by using his little finger and leisurely smoking a cigarette at the same time.

"Even though caught red-handed, Glen denied holding up the pawl. That guy had more gall than a barrel of monkeys. But when the charts were later checked, they didn't jibe with the integrator readings during his shift. That's when Glen got the old heave ho. He left town in a hurry, before the other firemen had a chance to catch up with him.

"The chief still believed in his bonus system, so he had a lock put on the boiler meter. But that didn't work either. Trouble was that the key had to be left with the watch engineer so the charts could be changed during the week end. And it wasn't long before everyone eager to get some bonus dough had a duplicate key. Shadow of Glen was still hanging over that

This Yarway team has scored high—over a million installed on all types of steam equipment. Stocked and sold by 270 Industrial Distributors. For free Steam Trap Book, write YARNALL-WARING CO., 100 Mermaid Ave., Philadelphia 18, Pa.

go YARWAY with confidence

circle 304 on Reader Service card, p 97

circle 303 on Reader Service card, p 97

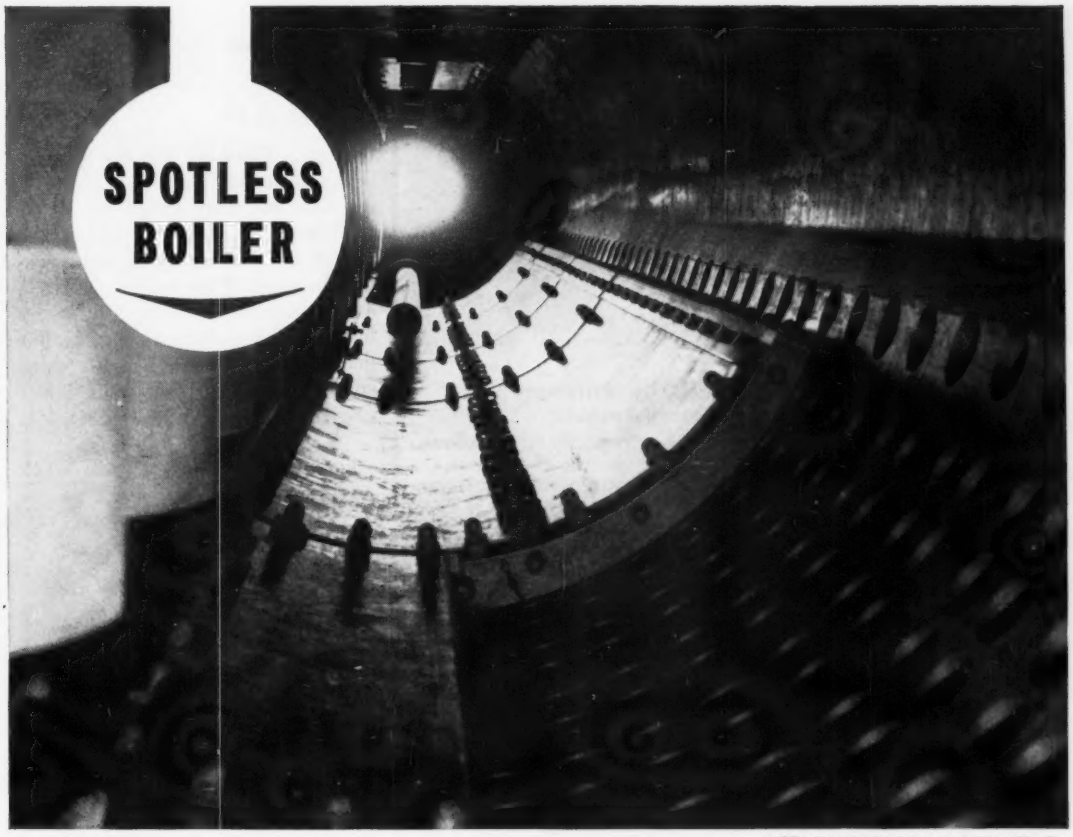
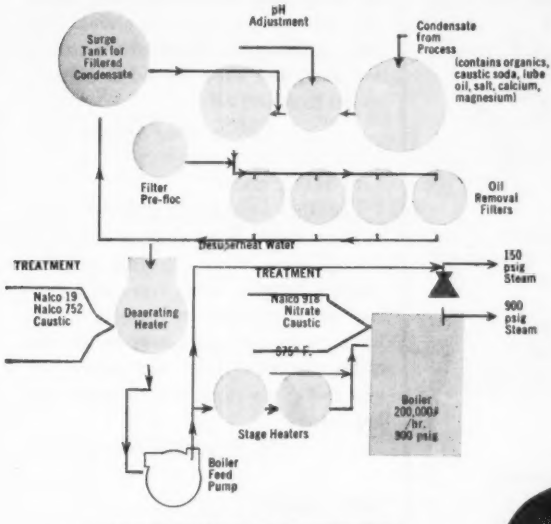


PHOTO COURTESY OF THE DOW CHEMICAL CO.

even though it operates on Contaminated Condensate!



FEEDWATER FLOWSHEET...

Pittsburg, California Plant of The Dow Chemical Co.

Nalco's continuous advisory service, easily as important as chemicals in solving this problem of contaminated condensate, simply doesn't fit into a chart. Consulting Service, in any water conditioning program, complements equipment and specialized services. It is part of the Nalco package . . . of results!

Contaminated condensate from process systems presents a complex water conditioning problem for boiler plant operators. In this system the solids in raw condensate run 15 to 80 ppm. Contaminants are lube oil and other hydrocarbons, caustic soda, salt, and traces of calcium and magnesium . . . a topnotch formula for promoting scale and sludge formation.

Working closely with a superbly cooperative plant operating staff, a Nalco Representative developed the water treatment plan. He provided the continuous counsel and coordination that keeps the boiler as it is shown here: free of sludge and scale . . . clean-to-metal after a full year's operation.

You, too, can count on the Nalco System for permanent, economical answers to water treating problems. Write or 'phone for details.

NATIONAL ALUMINATE CORPORATION

6222 West 66th Place Chicago 38, Illinois

Northwestern United States, Hawaii and Alaska: The Flox Co., Inc., Minneapolis 3, Minnesota

Canada: Alchem Limited, Burlington, Ont.

Italy: Nalco Italiana, S.p.A.

Germany: Deutsche Nalco-Chemie GmbH.

Spain: Nalco Espanola, S.A.

Nalco

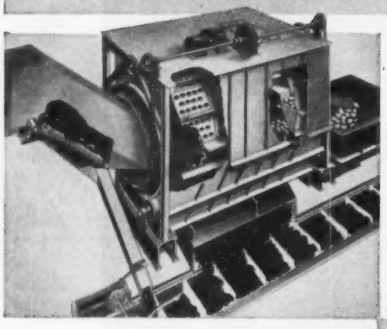
SERVING INDUSTRY THROUGH PRACTICAL APPLIED SCIENCE

Nalco CHEMICALS

For more facts circle 305 on Reader Service card, p 97

More and more utilities now use this

Rugged Cost Cutting Coal Processing Equipment

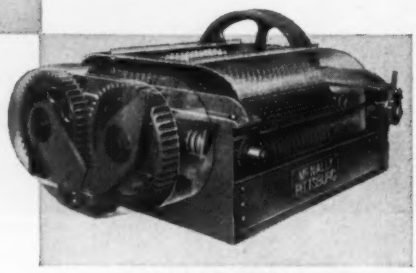


McNally Pittsburg Rotary Breaker

This heavy-duty unit allows positive control of top size in handling run-of-mine washery feed. Production of fines is held to a minimum. Without center shaft or spoke interference, costly maintenance is usually drastically reduced.

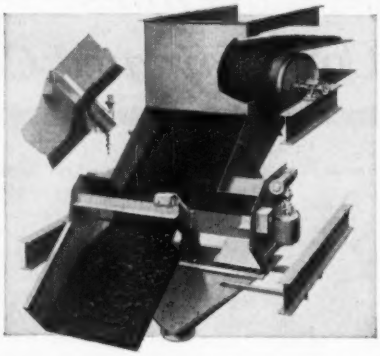
Gearmatic Stoker Coal Crusher

Built to handle heavy coal tonnages, these crushers have proved most efficient to reduce 8″ minus to stoker grades. They offer three major advantages: 1) high volume production; 2) accurate sizing; 3) low percentage of fines.



McNally Pittsburg Primary Coal Sampler

This automatic sampler (adjustable from 1 to 30 minutes) cuts out true samples of the coal stream. Cutter opening permits largest particle of stream to pass freely into cutter. Conveyor discharges into chute in which sampler is installed.



Ask the men who know coal from the ground up!

Your McNally Pittsburg man offers more than 37 years of experience in the preparation of coal. He can save *you* time and money in the selection of equipment to do your job more efficiently. *Write today!*

McNALLY PITTSBURG

MANUFACTURERS OF EQUIPMENT TO MAKE COAL A BETTER FUEL

McNally Pittsburg Mfg. Corp.
Dept. P, Pittsburg, Kansas
Gentlemen: Send me more information on these products:
☐ Rotary Breaker ☐ Coal Crusher ☐ Primary Coal Sampler

Name_____ Title_____

Company_____

Address_____

City_____ State_____

Marmaduke

Continued from page 154

brewery. Worst of all: the firemen began neglecting blowdown and leaving light and dirty fires.

"The chief finally threw in the sponge and gave up on his bonus system for good. Then one day he made a few pounds of steam himself by burning all his efficiency records. But that didn't happen until after three consecutive shifts showed a boiler efficiency of over 120%."—*SME*

Marmy's Mailbox

'Tis here you exchange blasts with the old boy

MARMY IS FIRST

I'm busy, but always find time to read Marmy first. Next follows *George Edwards*, then *My biggest boner*, and *Plant equipment news*. I also try to find time for *Plant problems* and *Practical ideas*.

W B REID, *Detroit, Mich.*

EXPERIENCES LIKE MARMY'S

I've had many interesting experiences in the power field, some very much like the ones Marmy tells about. I've been reading the Marmaduke stories for years and hope the old-timer continues to sound off.

F MCKUNE, *Phoenix, Ariz.*

LIFT TRUCK GOOD

I like the contaminated brine story in May, 1958. We had the same problem of brine poisoning from our lift-truck exhausts. After years of pleading we convinced management that battery-powered units were better. So today electrical jobs outnumber our gas units four to one. One learns the hard way.

P C ZIEMKE, *Clinton, Tenn.*

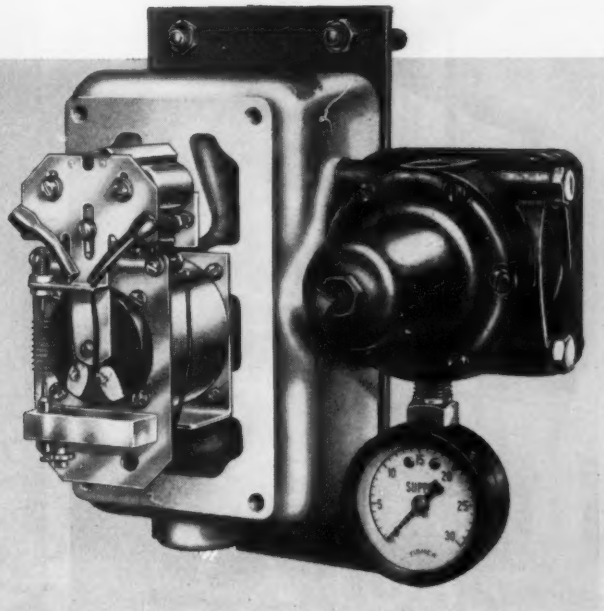
GOOD THEORY

The *Marmaduke Story* is swell. I enjoyed reading the book from cover to cover. I especially like the way Marmy works good theory into his tales.

J CASHEL, *New York, N. Y.*

Ask Your *FISHER/MAN* How To

SPEED THE INPUT SIGNAL to the CONTROL VALVE



FISHER

TYPE 543

ELECTRO PNEUMATIC TRANSDUCER

Available with or without a pneumatic valve positioner

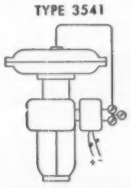
Here's an electro-pneumatic transducer developed for use in electrical control loops where the final control element is pneumatically operated. Explosion proof design makes it ideal for use under hazardous conditions. Input signals may range from 1 to 5 ma. through 10 to 50 ma.... output from 3 to 15 psi through 6 to 30 psi. Built-in volume relay permits direct operation of the pneumatic actuator from the Transducer. No extra relays or boosters needed. Relay can be serviced independent of electrical assembly. Unit is completely reversible by reversing input leads and rezeroing.

If you want additional information on the Type 543 Electro-Pneumatic Transducer write Fisher Governor Company.

TYPICAL CIRCUITS		
Input Current	Load Requirements of Controller	Actual Internal Resistance of Transducer
1 to 5 ma dc	3,000 ohms maximum	2,500 ohms ±125 ohms
1 to 5 ma dc	12,000 ohms ± .5%	12,000 ohms ± 50 ohms
10 to 50 ma dc	500 ohms maximum	57 ohms ± 4 ohms

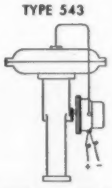
PERFORMANCE DATA	
Linearity	1% of full range
Air Consumption Rate	2 SCFH with 15 psi output pressure
Resolution Sensitivity	.05% of input range
Frequency Response	Complete frequency response data with Fisher topworks available

TYPE 3541



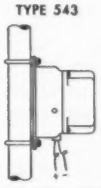
Electro Pneumatic Controller Mounted on Control Valve

TYPE 543



Transducer Mounted on Control Valve

TYPE 543



Transducer Mounted on Stand Pipe

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD... CHANCES ARE IT'S CONTROLLED BY...

FISHER GOVERNOR COMPANY

Marshalltown, Iowa / Woodstock, Ontario / London, England

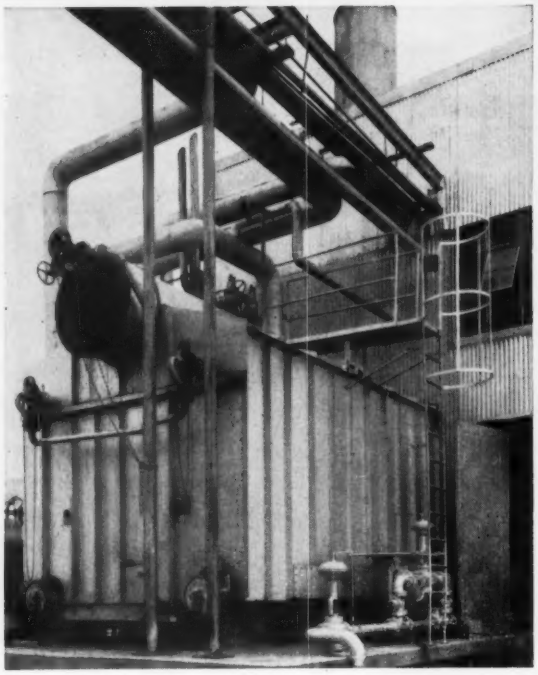
CONTINENTAL EQUIPMENT CO. DIVISION, Coraopolis, Pennsylvania

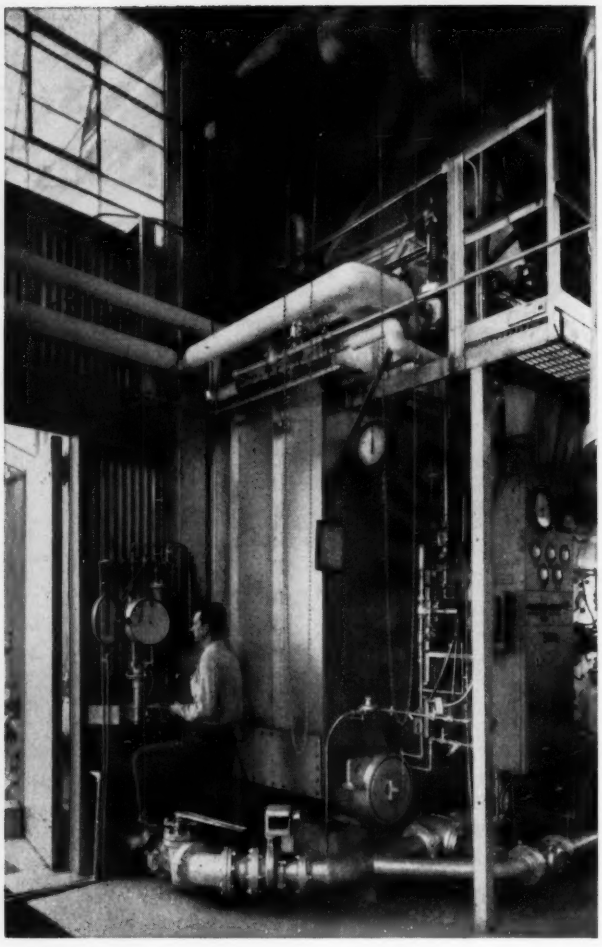
FISHER® Controls

SINCE 1880

For more facts circle 307 on Reader Service card, p 97

Processing wallboard at Kaiser Gypsum





Union Packaged Boiler takes increased load in stride

A good part of the steam for processing gypsum wallboard at Kaiser Gypsum Company's Long Beach plant is supplied by the 35,000 lb./hr. Union Type MH Packaged Boiler shown.

Semi-automatic fired with a normal operating pressure of 200 psi, this compact unit went on the job in 1956. Installed outdoors, it eliminated the need for further extension of the existing boiler house.

Although originally furnished to deliver steam for 2 out of 5 zones in a Coe Dryer, the MH was later hooked up to carry more of the load handled by an older boiler. Says the engineer-constructor, Kaiser Engineers: "The extra load demand on the Union Boiler was hardly noticeable from an operating standpoint."

Throughout industry, similar reports verify reliable Union performance on stiff assignments. Job-proved designs, complete shop assembly, compactness, easy installation and above average efficiency combine to make Union MH Steam Generators the best dollar-for-dollar buy on the market.

Available in sizes from 10,000 to 60,000 lbs./hr., standard packaged units can be readily equipped to handle a great diversity of needs formerly requiring costly field erection and special engineering.

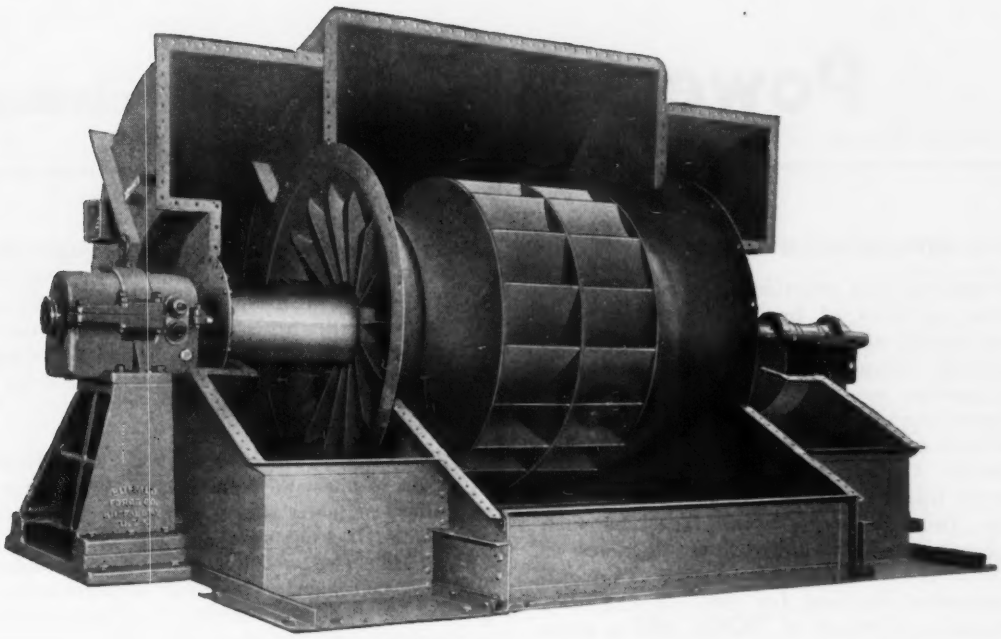
GET FULL DETAILS

on Union packaged boilers. Write for Bulletin MH 353 with cut-away illustrations, tube layouts and dimension tables.

UNION

UNION IRON WORKS

ERIE, PENNSYLVANIA



"Buffalo" Airfoils are Available in Capacities in Excess of One-Half Million CFM, Pressures to 80" Water.

"BUFFALO" AIRFOILS COST LESS TO OPERATE ...REQUIRE LESS MAINTENANCE

HERE'S WHY: If you are considering the use of airfoil fans for mechanical draft service, ponder these facts regarding the "Buffalo" Airfoil.

With a true peak mechanical efficiency of 92% and an extremely broad static efficiency curve, as compared to most competitive airfoil designs, the "Buffalo" Airfoil definitely costs less to operate. Major factors governing this efficiency are—a completely streamlined inlet with inlet bell and wheel flange forming a true half-circle—fixed or variable inlet vanes, where used, are placed well into the inlet throat to fully utilize horsepower reducing spin developed by the vanes—generous inlet boxes with external bracing give low entry loss—airfoil wheel incorporates proper blade passages for best air-flow through the wheel—scroll shape lets air stream from blade passages to housing channel with greatest ease—divergent outlet provides optimum static regain from cut-off.

This top efficiency, combined with the famous "Buffalo" "Q" Factor* Construction for a longer life with less maintenance, makes the "Buffalo" Airfoil best suited for this specialized service. For full details phone your Buffalo Engineering representative or write for Bulletin FD-905.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

BUFFALO FORGE COMPANY
Buffalo, N. Y.

Buffalo Pumps Division Buffalo, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

For more facts circle 309 on Reader Service card, p 97

Powerscope . . . A selective look at

Threat to national security . . .

stemming from practice of Federal Government agencies of buying heavy electrical equipment abroad is creating increasing concern throughout industry. Latest roar of protest comes from National Security Committee of NEMA. They call for limiting further imports of hydraulic turbines, hydraulic turbine-driven generators, heavy power transformers and large circuit breakers. The equipment is purchased by such defense-important government agencies as Bonneville Power Administration, TVA and equipment destined for AEC. J F Miller, managing director of NEMA, told a press conference that "rapidly growing dependence on foreign sources threatens this nation's ability to maintain adequate and continuous supply of electric power in time of national emergency."

Despite protests from domestic groups, foreign firms continue to bid low, get contracts.
The Brown-Boveri Corp recently copped an order to supply two 200,000-kw turbogenerators for the Los Angeles Department of Water & Power's new Haynes steam plant. The Swiss concern won with a bid of $9,260,800 as compared to lowest American bid—by GE—of $14,757,930. Award received approval of the city council by a 10-3 vote.

Glancing over shoulders at contract-signing time, both here and abroad, we see that . . . **Britain's Babcock and Wilcox Ltd has received a $3.5 million order to supply two coal-fired boilers for the Lagisza power station in Poland. Boilers will burn pulverized coal; each will supply 830,000 lb steam per hr at 1917 psi and 1010 F.**

Hitachi Ltd, Tokyo, will construct and supply material for a 30,000-kw thermic power station in Argentina. Contract is worth close to $6.3 million.

A $178,000 contract awarded to Cleaver-Brooks Special Products, Inc calls for furnishing sea-water desalting equipment for Wake Island. The firm will provide flash-evaporation distillation equipment to provide 100,000 gallons of potable water a day for civilian and military personnel stationed at and transiting the island.

Consolidated Edison Co of New York has ordered another 3600/1800-rpm close-coupled cross-compound steam turbine and fully-supercharged generating unit from Allis-Chalmers. It's similar in arrangement and rating to the 340-mw unit Con Ed now has on order with A-C for Unit 4 of the Astoria station. Steam conditions for Unit 4 are 2000 psig, 1050/1000 F and 2.0 in. Hg aboslute exhaust pressure.

Japan Atomic Power Generation Co has issued a letter of intent to British General Electric Co for a nuclear power station of the Calder Hall type. Contract is expected to be signed in July, but letter will enable the British firm to start detail design work immediately. Total cost of power station is put at about $84 million. The General Electric contract calls for about $56 million, remaining sum to be spent in Japan.

Sao Paulo University in Brazil has bought three ultra-centrifuges for uranium isotope separation from the German firm Sartorius Ag. Goettingen. Developers claim that power costs for gas centrifuging are only a small fraction of those of diffusion plants.

Demise of the street car . . .

. . . is helping protect New Orleans gas system from corrosion. S E Trouard and E A Wagner Jr, New Orleans Public Service Inc, told an AIEE symposium on cathodic protection that old rails from street-car systems are buried deep in the ground beneath gas lines to form anodes that prevent coated-steel gas pipes from corroding.

But, nation's largest battery maker, betting on an early revolution in the field of in-city and suburban auto transportation, is seriously backing the effort to bring back electric autos and street trucks. Electric Storage Battery Co already has designed batteries and assisted in engineering planning for the first new electric vehicles scheduled to appear this year—the C-V truck and Charles Town-About auto. With introduction of these vehicles, the battery firm believes that auto development might well be on its way to completing a full circle within half a century.

Seeing same possibilities, Sonotone Corp and American Motors Corp are launching a joint program to develop a "revolutionary" electric automobile with a self-charging battery. Program will seek the answers to cost, economy of operation, performance, size, weight and other questions.

this month's power-field happenings

ART SOMMER, Assistant Editor

What we need is education

Modern management must make a concerted effort through back-to-school education to catch up with "exploding" technology, Willard F Rockwell Jr, president, Rockwell Mfg Co, told the opening session of the 21st American Power Conference. "It is not enough," he warned, "for engineers to study the humanities, but nontechnical management must have comparable familiarity with technology." He reported that 90% of present total knowledge has been gained in the last 50 years, with technological breakthroughs adding such words as television, satellite and polyethylene to our everyday vocabulary. "Bankers, lawyers, politicians and other nontechnically trained management people are called upon to make decisions without sufficient background to take adequate account of their technical environment," he contended. As a step toward a solution, he called on engineers and engineering educators to initiate courses in technology for undergraduate college students in nontechnical schools and for practicing management people.

Challenge of world competition facing American industry, described as "more complex and more fateful than any set of conditions in our history," will multiply the burdens of engineers in future years. This is the opinion Brig Gen Herbert D Vogel (retired), chairman of TVA, expressed at the American Power Conference. The engineer, he said, must gear himself to assume executive positions as management decisions require increased technical knowledge. He pointed out that industry can do a great deal to widen horizons of today's engineering graduates through scholarships and fellowships, and through in-service training. "We must encourage men to go into graduate work," Vogel stated. He also expressed the belief that engineering societies and engineering colleges should recognize that broad learning cannot be obtained in four college years, or probably even in five.

A member of the East Orange (N.J.) board of education, Charles A Trelease, plans to ask his board colleagues to "explore the possibility" of shortening the 10-week summer vacation period to two weeks. The 180 days in the school year, he says, are hardly enough for the teenage mind to absorb all the knowledge a missile-age education demands. Loudest protests to date come from his two school-age daughters.

Columbia University, which 20 years ago conducted the nation's first experiments in atomic fission, has expanded its nuclear program to teach young engineers how to find practical uses for this enormous energy source. Announcement came as the university placed its second of two "subcritical" atomic reactors in operation on the Morningside Heights campus.

About 800 of the 1500 engineers employed by the Southern Bell Telephone & Telegraph Co in nine states have taken advantage of a company-sponsored continuing-education program. Courses are offered in fundamental, equipment, air-conditioning, microwave and plant-extension engineering.

First in a series of customer education seminars was held by Crane Packing Co in February. Its purpose: To provide plant operation and maintenance supervisors with information and recommendations on improved usage of mechanical packings and seals as a means of saving money and bettering production. Crane intends to conduct more seminars this year, each devoted to a different segment of industry.

Atomic breakthrough

First direct conversion of nuclear energy into electric power—bypassing use of huge steam turbines—was accomplished at Los Alamos Scientific Laboratories on April 7th. Researchers inserted a plasma thermocouple into the uranium-fueled core of the Omega reactor, producing an open circuit voltage of 3.8 and a short-circuit current of between 30 and 40 amp. The power operated a standard light bulb for 12 hours, after which the unit was shut down for analysis because, as a spokesman put it, "We got tired of standing around watching it." The successful experiment culminated three years of research sponsored by AEC.

Exchanging power for power

Completion of 79 miles of h-v transmission lines sets up a 2-way export of power between Austria and Czechoslovakia. Pact calls for Austria to send 200 million kw to Czechs between April and Sept from her hydro stations. Austria will get 100 million kw from Czech steam turbines between October and March. Czechs are planning a 620-mile 400-kv line across their country.

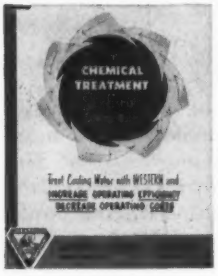
Write Western Today!

For these technical bulletins on

Water, Steam & Fuel Treatment

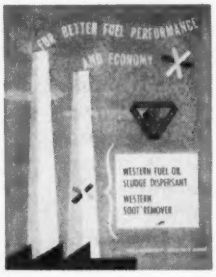
The Chemical Treatment of Boiler Feed Water. This technical bulletin contains a clear explanation of the causes of boiler water problems and Western's methods of solving them. Special emphasis on scale prevention, corrosion control, sludge dispersion, and suppression of foaming and carry-over.

Steam Plus CORAVOL Equals Protection From Corrosion. This technical bulletin tells how CORAVOL, the original amine process, gives complete protection from corrosion to your entire steam-condensate circuit. Clearly explains the theory of corrosion and the application of volatile amines to steam systems. Cites typical case histories of the use of CORAVOL in various plants and industries.



The Chemical Treatment of Industrial Cooling Water discusses common cooling water problems—scale, corrosion, algae, slime. Also presents Western's proven methods for controlling and preventing these conditions in cooling towers, evaporative condensers, process heat exchangers, engine and compressor jackets, chilled water systems, etc.

Better Fuel Performance and Economy discusses the causes and effects of sludge in fuel oil supplies and soot deposits in combustion areas. Shows how these troubles can be eliminated economically, dependably, and permanently with time-tested special Western formulas.



Also, Technical Bulletins on the chemical treatment of potable and plant water supply—refrigerating brine—sweet water systems. Also, the use of Dry Acid Scale Removers.

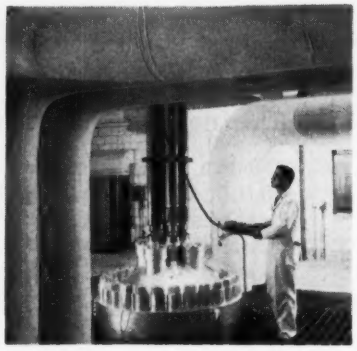
WESTERN CHEMICAL COMPANY — PIONEERS IN CHEMICAL WATER

Whatever your water, steam or fuel treatment problem may be, you can rely on special Western formulas and individual technical service to solve it dependably and economically.

WESTERN CHEMICAL COMPANY

713 Washington Street, Kansas City 5, Mo.

Reports from the field



Absolutely safe operation is goal of SPERT-III

Special Power Excursion Reactor Test No 3, a versatile research facility developed for studying and improving nuclear-reactor safety, went critical at 11:47 pm last Dec 19. Built at the AEC's National Reactor Testing Station in Idaho, the facility cost about $3.5 million.

SPERT-III is the latest in a series of reactors designed by Phillips Petroleum Company, as part of the AEC's program to find basic explanations for reactor behavior under runaway conditions. SPERT is a versatile reactor, and will be tested under various initial conditions of pressure—atmospheric to 2500 psi; temperature—68 to 668 F; and coolant flow—zero to 20,000 gpm. The facility can be used to investigate conditions applicable to pressurized as well as boiling-water reactors.

Photo, above, shows reactor's top cap and control mechanism. An electronics technician is manually checking out the control rods.

Evis Manufacturing Co ordered to stop false claims

The Federal Trade Commission has ordered Evis Manufacturing Co, San Francisco, Calif., to stop falsely claiming that its Evis Water Conditioner has any beneficial effect on water. The FTC ruled that scientific evidence and testimony in support of the charges clearly outweigh testimony given by the concern's user witnesses. Accordingly it granted an appeal by its trial counsel and vacated a hearing exam-

Another addition to the Vogt line of TOP QUALITY valves . . .

Forged Steel
WELDED BONNET

GENERAL GP PURPOSE

Gate and Globe
VALVES

150-800 Pounds Service

To eliminate forever potential body-bonnet leaks, Vogt engineers have developed these new General Purpose valves with seal welded bonnet joints.

This new addition to the world's most complete line of forged steel valves incorporates all the features of other Vogt GP valves—hard faced seats, hardened stainless steel wedges, drop forged pressure parts, and the numerous other advantages of Vogt's valve line.

The desirable safety feature of a back seat on the stem is retained while still offering the elimination of a possible body-bonnet leak.

Available NOW in both gate and globe types, ¼" thru 2", and in both socket weld and screw ends. These are priced identical to the bolted bonnet GP valves; gate valves the same as Series 12111 and globe valves the same as Series 12141.

Address Dept. 24A-FP for literature

Series 2801 Gate Valve
Illustrated

Series 2821 Globe Valve
Also Available

Both series identical in dimensions and have 13% chrome stainless steel trim.

Vogt

GENERAL GP PURPOSE — Vogt FOR BETTER VALVES

HENRY VOGT MACHINE COMPANY, Louisville, Ky.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Camden, N. J., St. Louis, Charleston, W. Va., Cincinnati.

FORGED STEEL

VALVES

For more facts circle 311 on Reader Service card, p 97

Ask the thousands of engineers who use CHESTERTON "64" STEAM PACKING

and they'll tell you...

1 "64" gives three to five times longer service because of its patented diagonal construction which permits many more "take ups" as it wears.

2 "64" stays resilient where other steam packings grow hard (because of "64"'s special heat resisting compound).

3 "64" costs less because it weighs 20% less and gives more feet to the pound (due to lighter weight of "64"'s non-vulcanizing compound).

WHICH MAKES SENSE TO YOU?

THIS:

OLD FASHION RUBBER BACK WHICH BURNS OUT

1. Has parallel plies of Asbestos which do not respond to gland or service pressure.
2. Requires a rubber back for expansion which fails on high heat.
3. Packing grows rock hard in service because of rubber cement between laminations

CONVENTIONAL PACKING HARDENS!

OR THIS:

NO WEAK RUBBER BACK

"64"

1. Has diagonal rather than parallel ply construction for self sealing action.
2. Remains soft and pliable in service because laminating compound resists hardening.
3. Old fashioned rubber back eliminated by giving expansion through patented diagonal design.

CHESTERTON "64" STAYS SOFT AND PLIABLE!

PACKING Chesterton SERVICE

You can purchase Chesterton "64" from any one of 300 local distributors. Write for catalogue and name of nearest Chesterton distributor.

A. W. CHESTERTON CO. • EVERETT 49, MASS.

America's Oldest Manufacturer of Mechanical Packings

Reports from the field

Begins on page 162

iners' initial decision, filed June 30, 1958, which would have dismissed the February 5, 1954 complaint for failure of proof.

Evis was ordered to discontinue more than a score of false claims. Specifically they are forbidden to represent that the unit

(1) has a catalytic effect on water or changes its physical behavior

(2) will solve hard-water problems, make hard water soft, or cause hard water to feel, taste or act softer

(3) will remove or reduce unpleasant odors or flavors in water

(4) will make water taste better or improve taste of beverages or food

(5) will save soap and reduce the cost of heating water

(6) will eliminate or reduce harshness of water to hands

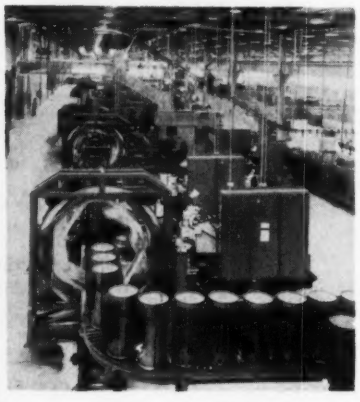
(7) will cause dishes or glassware to dry without leaving water stains

(8) will remove grease, prevent or remove scale and improve action of chemicals used for water softening

(9) will prevent, reduce or eliminate scum, rust stains or corrosion, or retard pitting of metal

(10) will leach out alkali and salts in soil, and reduce amount of water required for agricultural irrigation

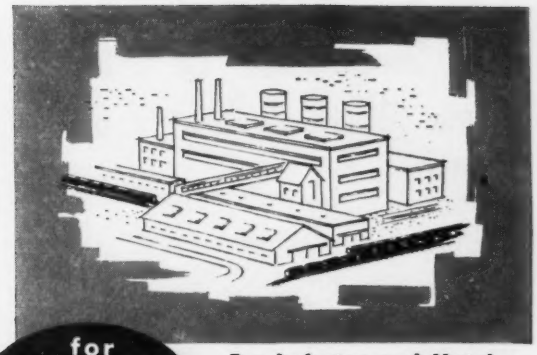
(11) will improve soil's texture or structure and growth or production of agricultural or orchard products.



Two-minute transformers made by mechanized plant

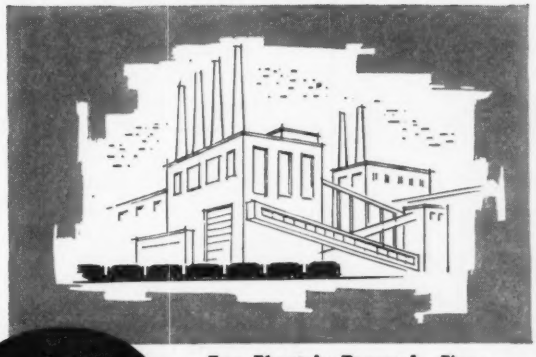
Using highly mechanized production and materials-handling equipment and modern quality control, this new Westinghouse plant turns out one distribution transformer every two

FUEL SATISFACTION* is a Natural . . .



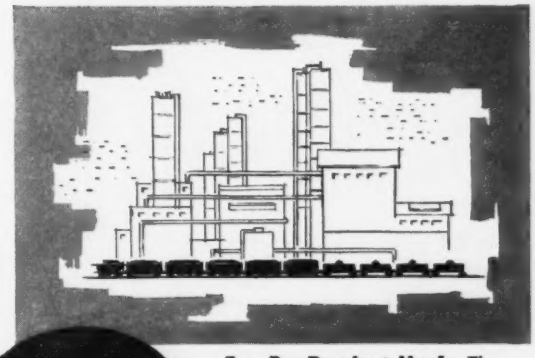
for INDUSTRY and METALLURGY

For Industry and Metallurgy! Fuel Satisfaction coals are high in carbon content, low in ash and sulphur. They are unexcelled for metallurgy.



for ELECTRIC POWER

For Electric Power! Electric power companies have tested and proved the outstanding steam-producing characteristics of Fuel Satisfaction coals.



for BY-PRODUCT USE

For By-Product Use! The cleanliness and purity of Fuel Satisfaction coals make them ideal for use in by-product plants.

- **ROANOKE**
  N&W Coal Traffic Dept.
  Telephone Diamond 4-1451
  Ext. 3313, 423, 3249, 3732
  Roanoke, Virginia
- **BOSTON**
  833 Chamber of Commerce Building
  Telephone LIberty 2-2229
  Boston 10, Massachusetts
- **CHICAGO**
  660-664 Marquette Building
  140 S. Dearborn Street
  Telephone RAndolph 6-4634
  Chicago 3, Illinois
- **CINCINNATI**
  913 Dixie Terminal Building
  Telephone DUnbar 1-1325
  Cincinnati 2, Ohio
- **CLEVELAND**
  Room 722,
  The Illuminating Building
  Telephone MAin 1-7960
  Cleveland 13, Ohio
- **DETROIT**
  1514 Book Building
  Telephone
  WOodward 1-2340 or 1-2341
  Detroit 26, Michigan
- **ST. LOUIS**
  2059 Railway Exchange Building
  Telephone MAin 1-1180
  St. Louis 1, Missouri
- **WINSTON-SALEM**
  1105 Reynolds Building
  Telephone PArk 2-7116
  Winston-Salem 1, North Carolina

Fuel Satisfaction coals are mined and processed along the Norfolk and Western and precision transported to meet your most exacting requirements. For details on these all-purpose coals get in touch with the Norfolk and Western Coal Bureau nearest you. They will welcome your inquiries.

* FUEL SATISFACTION is the name given the many fine brands of superior all-purpose Bituminous Coal mined along the N&W.

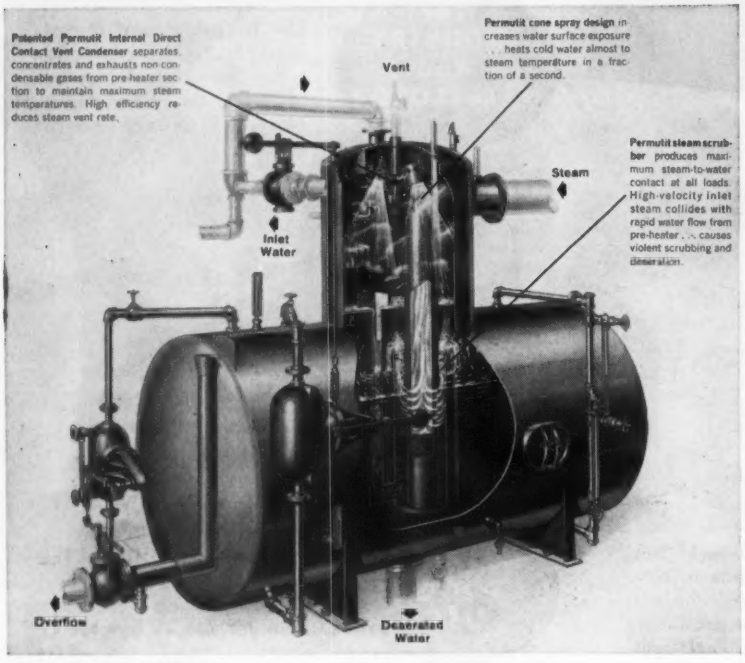
Norfolk and Western Railway

CARRIER OF FUEL SATISFACTION

For more facts circle 313 on Reader Service card, p 97

FLUIDICS

is a Pfaudler Permutit program providing
the know-how
the equipment
and the experience
for solving problems involving fluids.


Patented Permutit Internal Direct Contact Vent Condenser separates, concentrates and exhausts non-condensable gases from pre-heater section to maintain maximum steam temperatures. High efficiency reduces steam vent rate.
Permutit cone spray design increases water surface exposure . . . heats cold water almost to steam temperature in a fraction of a second.
Vent
Steam
Permutit steam scrubber produces maximum steam-to-water contact at all loads. High-velocity inlet steam collides with rapid water flow from pre-heater . . . causes violent scrubbing and deaeration.
Inlet Water
Overflow
Deaerated Water

FLUIDICS AT WORK

New deaerators guarantee less than 0.005 ml/l oxygen at all loads

This is the new Permutit Type B Deaerator. Both horizontal and vertical designs hold oxygen to 0.005 ml/l at all loads up to a peak of 150,000 lbs/hr.

No trays to be removed or cleaned. Tubeless internal vent condenser eliminates tube cleaning, also.

30,000, 50,000, and 70,000-lbs/hr horizontal units are available from stock. They come as packaged units with all internals, including sprays, completely assembled. Pre-fitted float-cage and gauge-glass piping further simplify installation.

Capacities from 150,000 to as much as 3,000,000 lbs/hr are available in Permutit Type A Deaerators.

For more information, write to our Permutit Division, Dept. PO-59, 50 West 44th St., New York 36, N.Y.

Fluidics covers such varied phases of fluid handling and control as:

corrosioneering	drying
water treatment	blending
waste treatment	metering
reactions	valving
ion exchange	piping
gas analysis	pumping
agitation	storing

Whenever you have a fluid-handling problem, look to this Pfaudler Permutit FLUIDICS program for the best solution.

PFAUDLER PERMUTIT INC.

Specialists in FLUIDICS . . . the science of fluid processes

Reports from the field

Begins on page 162

minutes. The Athens, Ga. plant contains almost five miles of materials-handling equipment — in-floor tow lines, overhead monoveyors, power-and-free conveyors.

One feature of the transformers is a redesigned core and coil, progressively wound to simplify manufacturing problems and improve performance characteristics.

Entire plant is laid out for straight-through flow of materials from receiving to shipping floor, through major areas of tank and core fabrication and coil manufacture. Completed tanks, above, move off tank-fabricating line on one conveyor, are automatically upended so a new conveyor can take over. Each transformer has a punch card, stamped with date, operator's number, gallons of oil put in —a complete record of the events of its two-minute life history.

Calendar of Events

May 18-20—Instrument Society of America, Fifth National Symposium on Instrumental Methods of Analysis. Shamrock - Hilton Hotel, Houston, Texas. Details from H S Kindler, ISA, 313 Sixth Ave, Pittsburgh 22, Pa.

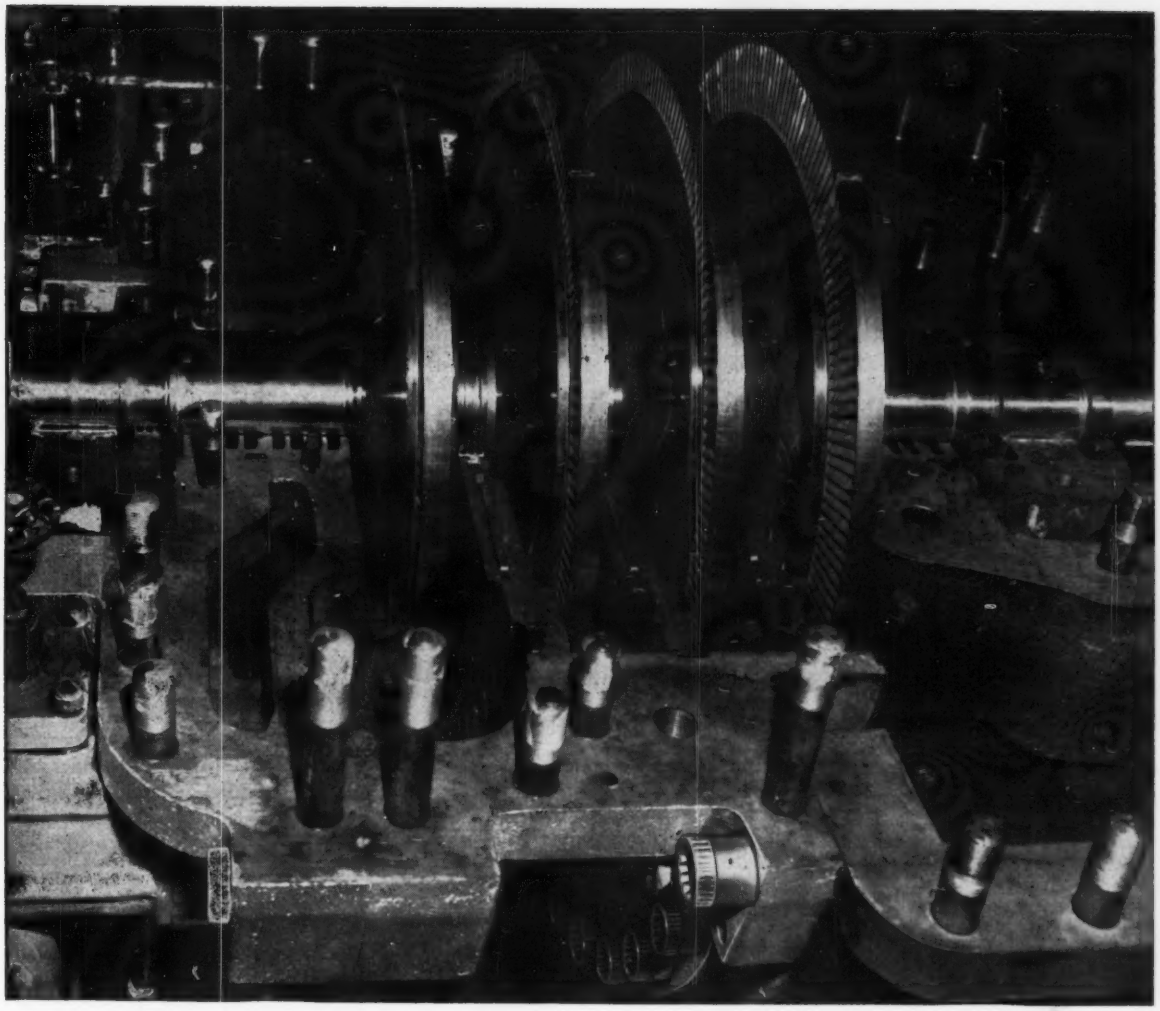
May 25-27 — Instrument Society of America, National Telemetering Conference. Cosmopolitan Hotel, Denver, Colo. Details from R Schmidt, Avco Mfg Co, 201 Lowell St, Wilmington, Mass.

May 31-June 5—Columbia University, School of Engineering, Annual Industrial Research Conference. Arden House, Harriman, N. Y. Details from M F Garvey, Columbia University, New York City.

June 2-4—West Virginia University, 1959 Appalachian Underground Corrosion Short Course. Morgantown, W. Va. Details from J H Alm, Room 605, Two Gateway Center, Pittsburgh 22, Pa.

June 10-12—Instrument Society of America, 2nd International Symposium on Gas Chromatography.

continued



THE INSIDE STORY OF A MURRAY HIGH SPEED COMPRESSOR

DRIVE TURBINE REVEALS THE REASONS FOR MURRAY'S UNIVERSAL ACCEPTANCE

A look at MURRAY'S rugged construction from the inside shows the husky shaft and heavy accurately formed discs with generous sized hubs designed to withstand the axial and radial stresses imposed by this type of service.

Large-dimension disc rims receive the specially contoured stainless steel blades with the Murray integral shroud. This insures smooth steam passages with maximum strength.

Short bearing spans insure smooth operation and eliminate the hazard of operating in critical speeds.

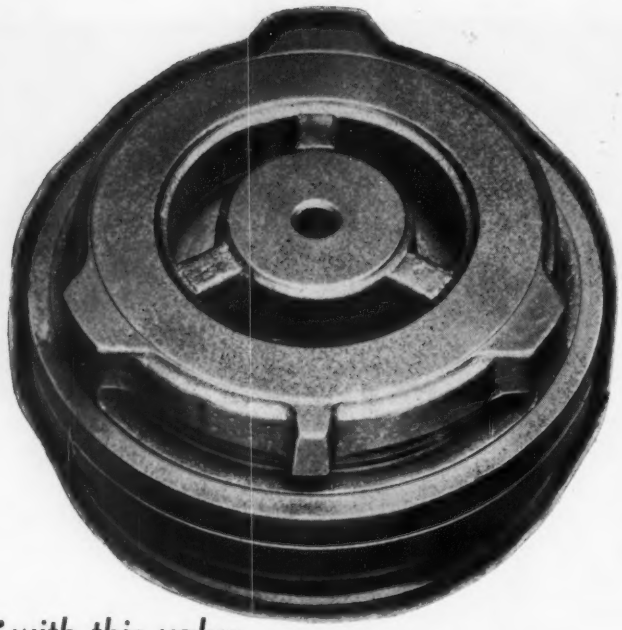
A look at the heavy flanges and husky bolting in the actual unretouched shop photo shown above bears out the extreme ruggedness that typifies every feature of Murray construction.

Our nearest representative will gladly help you solve your high speed compressor drive turbine requirements. Just write to Murray Iron Works Company, Burlington, Iowa, for his name.

Murray
TURBINES

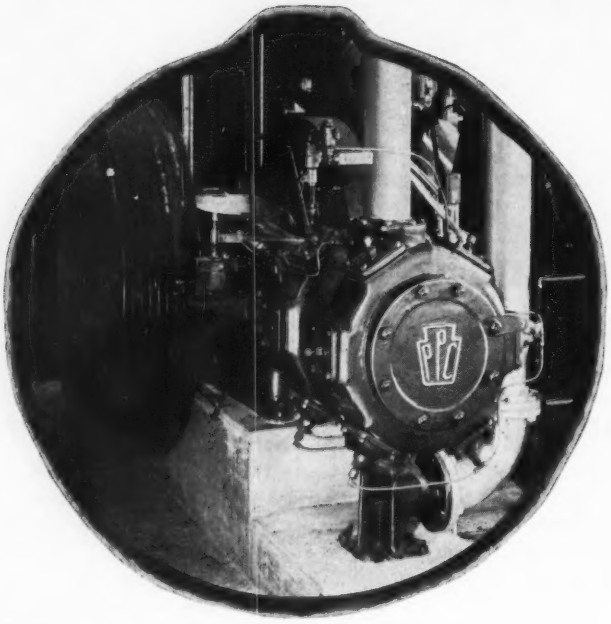
MURRAY IRON WORKS COMPANY • BURLINGTON, IOWA
Builders of Steam Power Equipment for Nearly a Century

For more facts circle 315 on Reader Service card, p 97



*with this valve

COMPRESSOR RUNS DAY AND NIGHT FOR 20 YEARS



Unusual? Yes, when you are not *getting* performance like this. No, when you have a Pennsylvania Compressor on the job. Long, long service without downtime is standard operating procedure with every Pennsylvania Compressor.

*Reason: the Pennsylvania Air Cushion Valve, constructed without nuts, bolts or screws. Stainless steel valve discs lift against a soft cushion of air; there is no flexing or bending action to weaken them. They will remain perfectly seated over long periods of service.

The compressor above delivered over 20 years of continuous performance . . . three days were lost once when it was moved, but that's all. Isn't it time you were on the receiving end of this kind of sure, sustained performance? Write today for your free copy of "Compressors for Industry" which describes Pennsylvania Compressors from 10 to 350 hp.

PENNSYLVANIA PUMP AND COMPRESSOR CO.

Easton, Pa. Earning Customer Confidence Since 1920

Reports from the field

Begins on page 162

East Lansing, Mich. Details from H S Kindler, ISA, 313 Sixth Ave, Pittsburgh 22, Pa.

June 14-18 — American Society of Mechanical Engineers, Semiannual Meeting. Chase-Park Plaza Hotels, St. Louis, Mo. Details: ASME, 29 W 39th St, New York 18, N. Y.

June 15-19—New York University, College of Engineering, course on thermoelectric materials. Details from Dr J P Nielsen, NYU College of Engineering, New York City, N. Y.

June 18-20—American Society of Mechanical Engineers, Applied Mechanics Div, Conference. Virginia Polytechnic Institute, Blacksburg, Va. Details from ASME, 29 W 39th St, New York 18, N. Y.

June 22-26—Air Pollution Control Association, Annual Meeting. Hotel Statler, Los Angeles, Calif. Details from APCA, 4400 Fifth Ave, Pittsburgh 13, Pa.

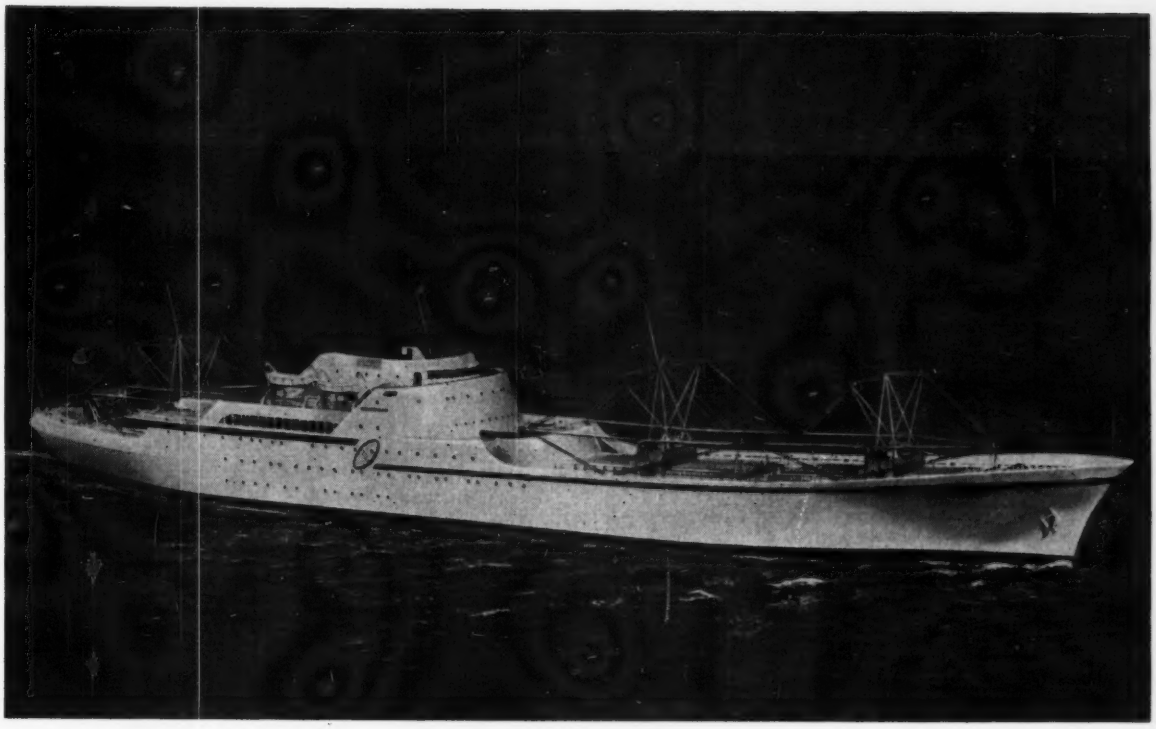
June 24-26—Instrument Society of America, 2nd Nuclear Instrumentation Symposium. Idaho Falls, Idaho. Details from H S Kindler, ISA, 313 Sixth Ave, Pittsburgh 22, Pa.

June 29-July 3—New York University, College of Engineering, course on ductile iron. Details from Dr J P Nielsen, NYU College of Engineering, New York City, N. Y.

July 26-Aug 7—Columbia University, Dept of Industrial and Management Engineering, Eighth Utility Management Workshop. Arden House, Harriman, New York. Details from Mrs Rae Wygant, 409 Engineering Bldg, Columbia U, New York

Largest slab of concrete measures 4597 cu yd

Largest continuous monolithic slab of concrete ever cast in the New England states will hold up the generator

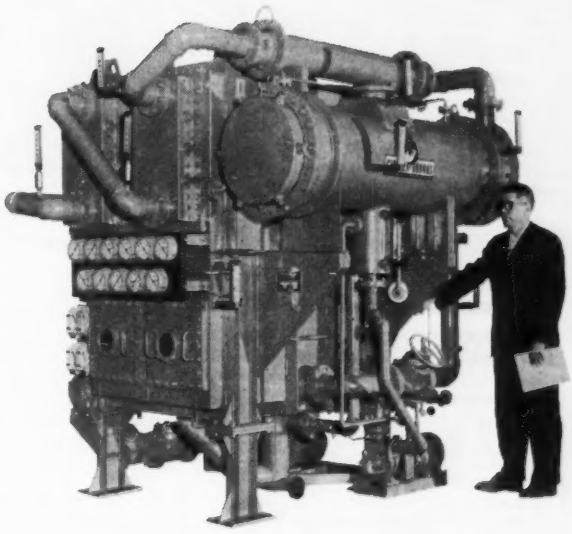


When America's First Nuclear-Powered Passenger Cargo Ship Goes to Sea...

BRIDGEPORT EVAPORATOR TUBES WILL BE ABOARD

The Nuclear Ship, *Savannah,* first of America's nuclear-powered merchant ships, now under construction at New York Shipbuilding Corporation, will be the first sea-going example of atoms for peace in the world.

She will embody the latest in nuclear design, technology and equipment. Part of *Savannah's* modern equipment will be Cleaver-Brooks Flash Evaporators with their Bridgeport 90-10 Cupro-Nickel tubes. These evaporators combine fast evaporation, low rate of scale formation, simplicity of operation, and low installation and operating costs. Their uninterrupted service depends, in large measure, on the quality of the evaporators' tubes while meeting highly varied "world-wide" corrosive media.



Bridgeport 90-10 Cupro-Nickel tubes have an excellent operating record in ship and shore installations . . . a record based on nearly a century of progress in the manufacture of condenser and heat exchanger tube of a wide range of alloys.

Whatever your needs—ashore or at sea; atomic or more conventional, new construction or retubing—you'll find that they will be completely fulfilled by Bridgeport's Condenser and Heat Exchanger Tubes. And Bridgeport's Technical Service Staff is always ready to assist you in every way. Call your nearest Bridgeport Sales Office, or write for a copy of the Bridgeport Condenser Tube Handbook, Dept. 5405.

Bridgeport BRASS CO.

BRIDGEPORT BRASS COMPANY

Bridgeport 2, Conn. • Sales Offices in Principal Cities

Specialists in Metals from **A***luminum to* **Z***irconium*

For more facts circle 317 on Reader Service card, p 97

STEAM TURBINE PEFORMANCE AND ECONOMICS

Here is a guidebook and reference on calculating steam-power-plant performance and its applications in preparing economic studies. Includes practical helps for the power-plant designer in selecting large turbines to meet specific needs . . . preparing turbine heat balances . . . estimating comparative performance data. Performance characteristics are given in graph form, with methods and background material also provided. **By R. L. Bartlett, Large Steam Turbine-Generator Dept., General Electric Co. 308 pp., 182 illus., $12.50**

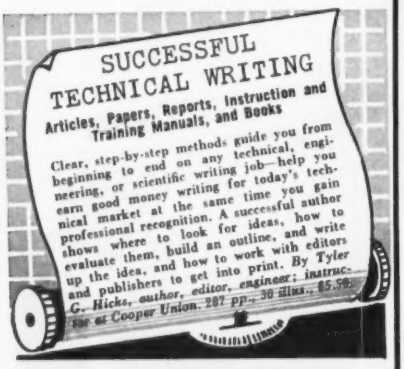
PLANT OPERATORS' MANUAL

Shows steam engineers and other power services personnel how to maintain and operate equipment. Gives methods and pointers which will help them not only in daily work but also in future upgrading and license examinations. Sequence illustrations show each operation step-by-step. Boilers, steam engines, turbines, diesel engines, pumps, compressors, and similar equipment are covered. Tells how to use latest instruments and maintenance tools in the power field. **By Steve Elonka, Assoc. Ed., Power. 292 pp., over 1500 illus., $7.50**

ELECTRICAL MACHINES

Direct and Alternating Current

New Second Edition, Just Published—Up-to-date coverage of electrical machinery, discussing in detail practically all types of modern rotating energy converters as well as such associated static equipment as transformers, rectifiers, and manually and automatically operated electrical control systems. Deals with fundamentals, so you can understand special equipment which is a modification of a fundamental type. **By C. S. Siskind, Purdue Univ. 565 pp., 325 illus., $8.00**


SUCCESSFUL
TECHNICAL WRITING
Articles, Papers, Reports, Instruction and Training Manuals, and Books
Clear, step-by-step methods guide you from beginning to end on any technical, engineering, or scientific writing job—help you earn good money writing for today's technical market at the same time you gain professional recognition. A successful author shows where to look for ideas, how to evaluate them, build an outline, and write up the idea, and how to work with editors and publishers to get into print. By Tyler G. Hicks, author, editor, engineer; instructor at Cooper Union. 287 pp., 30 illus., $5.50

10 DAYS' FREE EXAMINATION

McGraw-Hill Book Co., Dept. P-5
327 W. 41st St., New York 36, N.Y.

Send me book(s) checked below for 10 days' examination on approval. In 10 days I will remit for book(s) I keep, plus few cents for delivery costs, and return unwanted book(s) postpaid. (We pay delivery costs if you remit with this coupon—same return privileges.)

- ☐ Bartlett—**Steam Turb. Perf. & Econ.**, $12.50
- ☐ Elonka—**Plant Operators' Manual**, $7.50
- ☐ Siskind—**Electrical Machines, 2 Ed.**, $8.00
- ☐ Hicks—**Successful Tech. Writing**, $5.50

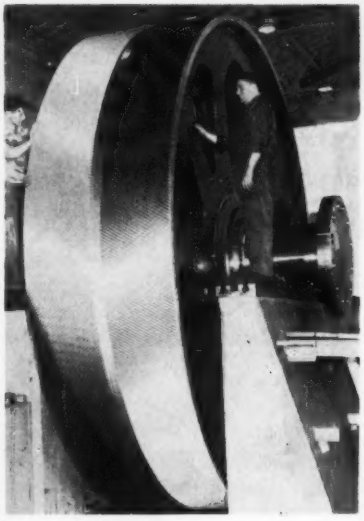
(PRINT)
Name .....
Address .....
City ..... Zone ..... State .....
Company .....
Position .....
For price and terms outside U. S. write McGraw-Hill Int'l, N. Y. C. P-5

Reports from the field

Begins on page 162

and boiler of a new $24.5 million steam power plant. The 120x209-ft concrete mat is 5-ft thick, contains 500 tons of reinforced steel.

There could be no shrinkage cracks. A moderate cement factor was used, with as little added water as possible. Dissipation of heat of hydration was even—a commercial retarding densifier was added to the concrete, 4 oz per sack of cement. Mixed design called for 670 lb of ½-in. gravel, 1240 lb of ¾-in. gravel, 1275 lb sand and 498 lb cement per cu yd of concrete. Upon completion of the slab, surface was flooded with water 3-in. deep for curing.



Big gear for big ship: atomic vessels making ready

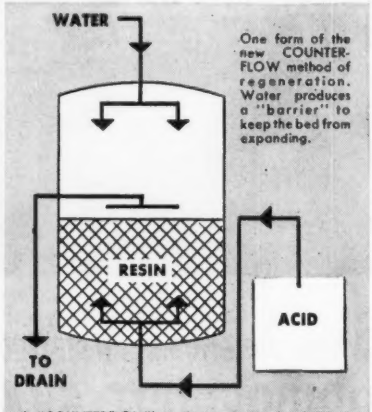
World's first atomic merchant ship, the *NS Savannah*, will be driven by a 70,000-lb bull gear, above. Gear measures 176 in. in diameter, 48 in. across the gear face. Herringbone pattern is made up of 583 gear teeth which will deliver power to the ship's single propeller. Steam produced in an atomic reactor will drive a De Laval turbine to spin the gear.

Launching of the *Savannah* is expected sometime this summer. National U.S. Radiator Corp, Cyclotherm Div, is installing a marine steam generator capable of producing 7500 lb per hr. Babcock & Wilcox Company will furnish the pressurized-water reactor. *Savannah*, a 21,800-

ILLCO-WAY ionXchange

COUNTERFLOW*

REGENERATION OF ION-EXCHANGERS


WATER
RESIN
ACID
TO DRAIN
One form of the new COUNTERFLOW method of regeneration. Water produces a "barrier" to keep the bed from expanding.

* "COUNTERFLOW" is the trade mark of Illinois Water Treatment Company equipment utilizing a distinctly new principle of regeneration. Pat. pending.

"COUNTERFLOW" is a method whereby upward regeneration, which has long been recognized as most desirable, is successfully accomplished by establishing a "barrier" at the resin face.

LOOK AT THESE

RESULTS!

- De-ionizer in a power plant. Conductivity of effluent improved from 10 micromhos to 4 micromhos after conversion to COUNTERFLOW. Cation leakage, expected at 4 ppm with downflow regeneration, actually is only 1 ppm.
- Chemical company in Middle West, 480 ppm TDS in raw water. Expected cation leakage with conventional regeneration, 9 ppm; with COUNTERFLOW, only 1.2 ppm.
- Distillery in Middle West. TDS in raw water, 575 ppm. Expected cation leakage with conventional equipment, 6 ppm; with COUNTERFLOW, is actually only 1.5 ppm.
- Western power plant, converted to COUNTERFLOW. Savings in acid reduction, $16,000.00 per year. TDS in raw water, 342 ppm. Predicted cation leakage from curves for conventional design equipment, 4 ppm; with COUNTERFLOW, actually only 1.6 ppm.

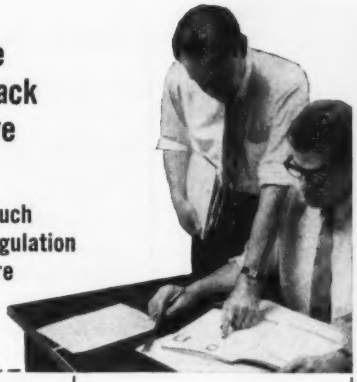
ILLCO-WAY

ILLINOIS WATER TREATMENT CO.
840 Cedar St.
Rockford, Ill.

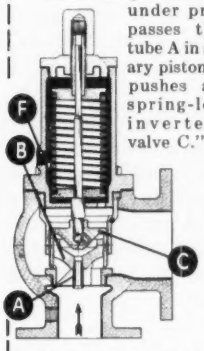
NEW YORK OFFICE: 141 E. 44th St., New York 17, N.Y.
CANADIAN DIST.: Pumps & Softeners, Ltd., London, Ont.

"How does the Klipfel #135 back pressure valve work?"

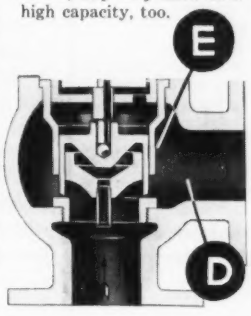
How can it give such close pressure regulation (4% over the entire capacity range)? Here's the story:



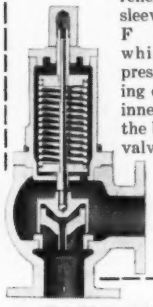
"Controlling inlet pressure and flow in a pipe line is all any back pressure valve does. How *well* it does this is, however, a different story. In this Klipfel Valve liquid under pressure passes through tube A in stationary piston B, and pushes against spring-loaded, inverted-cup valve C."



"When liquid pressure exceeds spring pressure, valve lifts open, letting liquid flow into outlet chamber D. This shows how Klipfel No. 135 Valves give such close regulation; why they have such high capacity, too.



"This is the same back pressure valve, modified to act as a relief valve. As you might guess, relief valves prevent excess pipe line pressures by relieving to the atmosphere. The only difference between the two valves is that the relief valve has no sleeve E and vent F (above)—which prevent pressure from acting downward on inner valve C in the back pressure valve."



"MOST IMPORTANT FEATURE in any back pressure or relief valve (aside from dependability) is smooth, chatter-free opening and closing. Also, relief valves should close tightly, but this isn't so important in back pressure valves."

• **For the complete story of back pressure and relief valves, without cost or obligation, write for Bulletin 454.**

If you'd like information on Reducing Valves, ask for Bulletin 154 . . . and for valuable data on Temperature Regulators, Bulletin 354-A.

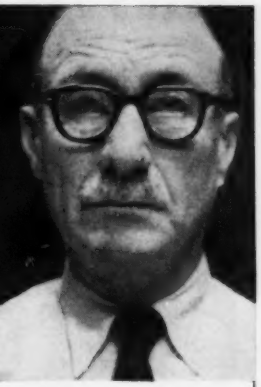
call for a valve from

Klipfel

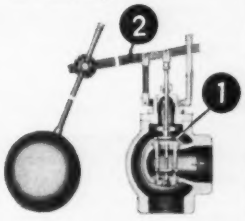
HAMILTON • OHIO

"Which type float valve do you need?"

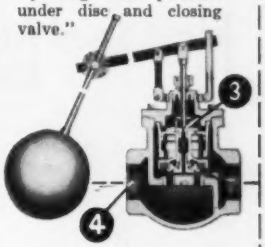
Here are some basic facts—taken from the Klipfel catalog*—which will help you decide.



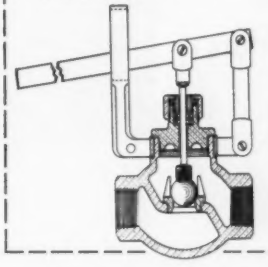
"To control liquid level in an open tank where tight closing is not essential, select a simple, direct acting, balanced float valve such as this Klipfel No. 27. Inner valve (1) opens as float drops. By reversing the lever (2), valve closes as float drops."



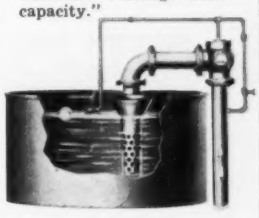
"Single seated float valves close tightly, prevent damage or waste from overflow due to valve leakage. Internal pilot action adds pressure of incoming liquid to buoyance of the float, keeping valve tightly closed. When pilot port (3) opens, water escapes through outlet (4). When it closes, pressure builds up above piston, equalling inlet pressure under disc and closing valve."



"This single-seated, all-metal float valve is ideal for tight closing with fluids injurious to rubber parts. Available in stainless steel or other corrosion-resistant materials to control levels of chemicals, fruit juices, etc."



"External-pilot-operated float valves use a small float valve in the tank to actuate a large main valve conveniently positioned outside the tank. This simplifies maintenance without reducing tank capacity."



*Much useful information on float valves and level control valves is available free in Klipfel Bulletin 254. Write on your company letterhead or ask for the complete catalog on all types of Klipfel automatic regulating valves.

Klipfel VALVES, INC.

Automatic Temperature-and-Pressure-Regulating Valves Since 1902

Float Valves • Temperature Regulators • Back Pressure Valves • Reducing Valves

A DIVISION OF THE HAMILTON-THOMAS CORPORATION

For more facts circle 326 on Reader Service card, p 97

HERE'S THE STORY...

ON OUR NEW

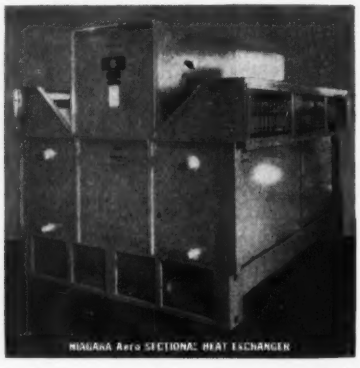
Automatic PACKAGED Firing Units

Be convinced . . . Send for Bulletin #28, which illustrates and explains all the advantages of this outstanding Burner in a complete packaged Unit . . . equipped with the latest in electronic safety controls to give *automatic start*, automatic flame modulation, and automatic shut-down . . . Here is truly automatic, economical, clean, and safe "Packaged" Boiler or Furnace Firing.

National Airoil
BURNER COMPANY, INC.
Main Office & Factory: 1250 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.
SOUTHWESTERN DIVISION 2512 SOUTH BOULEVARD HOUSTON 6, TEXAS
INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT
For more facts circle 321 on Reader Service card, p 97

This Self-Contained Fluid Cooling System

. . . gives most accurate temperature control



Applied in cooling industrial machines or processes to temperatures approaching the ambient wet-bulb, the NIAGARA *Aero* HEAT EXCHANGER is independent of any more than a nominal water supply or disposal. The coolant system is a closed one, free from dirt and maintenance troubles.

Heat is removed from your process *at the rate of input*, giving you precisely the temperature you require and assuring the quality of your product. Heat may be added to prevent freezing in winter or for better control in a warm-up period. Liquids or gases are cooled with equal effectiveness.

Heat is rejected outdoors. Only the little water evaporated on the cooling coils in the air stream, or discharged to prevent hardness build-up, is consumed.

Niagara sectional construction saves you much installation and upkeep expense, gives full access to all interior parts and piping. Your equipment always gives you full capacity and "new plant" efficiency.

Write for Niagara Bulletin No. 132 for complete information

NIAGARA BLOWER COMPANY
Dept. P-5, 405 Lexington Ave., New York 17, N.Y.
District Engineers in Principal Cities of U. S. and Canada

For more facts circle 322 on Reader Service card, p 97

Reports from the field

Begins on page 162

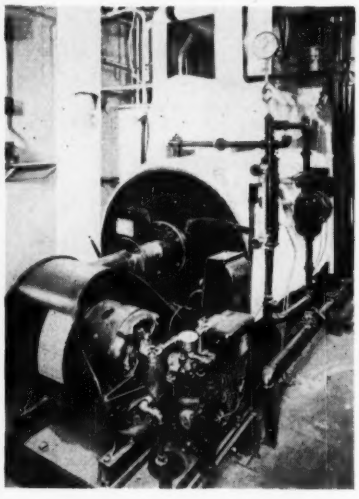
ton ship, should be able to circle the globe 14 times without refueling.

USS Long Beach, a nuclear-powered guided-missile cruiser, is also making headway. To run the *Long Beach*, nuclear reactors will generate steam which will go to a heat exchanger. There more steam will be produced and piped to General Electric Company propulsion turbines.

Clearinghouse established for northern coal info

Northeastern Coal Bureau has been formed by Edmund McCarthy, a consulting engineer with offices at 122 E 42nd St, New York 17, N. Y.

Bureau will handle information on coal originating in northern producing districts for movement to rail destinations in northern states. It will collaborate with design engineers, equipment manufacturers and steam-power engineers to help up boiler performance, lower costs.



Packaged-boiler production reaches 20,000 mark

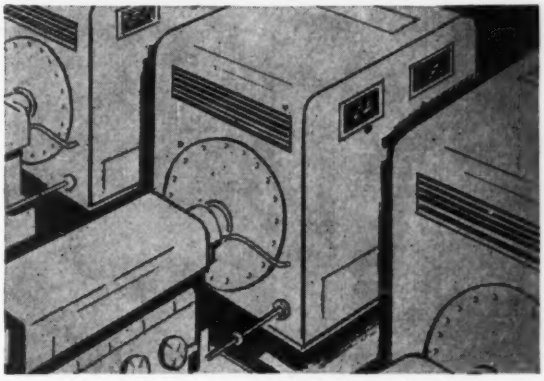
Shown above is the first packaged boiler. Turned out by Cleaver-Brooks Company in 1932, No. 1 is still going strong. Now, 26 years afterward, No. 20,000 has rolled off production lines, one of four units destined for a Rutgers U dorm.

Portable boilers were developed for highway contractors and road

Here's why you save by specifying Silicone Insulated Drive Motors

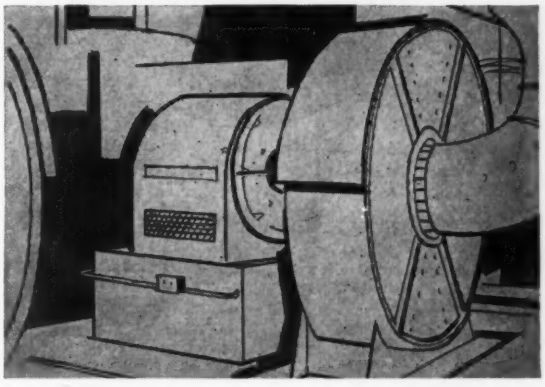
They're More Reliable

Utility engineers report that auxiliary drive motors carry 30% to 50% overloads without strain when they're designed to use the extra thermal stability of Dow Corning Silicones to increase service factor. That's greater assurance of service continuity than possible with any other insulation! This same thermal stability means top reliability in high ambient areas. Silicone insulated motors keep going despite overloads and ambients that cause other motors to fail.



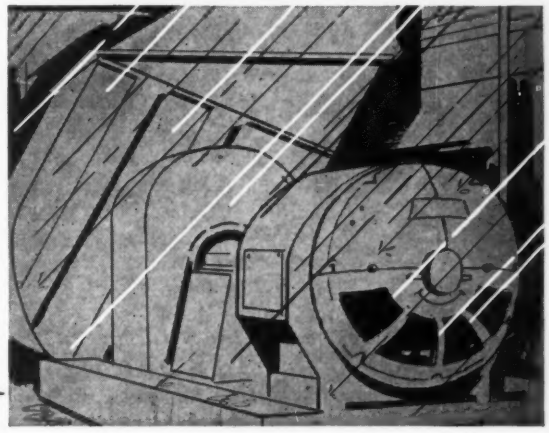
Smaller Motors Do The Job

By specifying motors with horsepower ratings matched to normal loads and letting the increased service factors provided by silicones carry the overloads, many companies now pay less for auxiliary drive motors. Following this practice, savings are realized not only in initial equipment costs . . . but in operating costs as well. Part-load inefficiencies and poor power factor resulting from overmotoring are eliminated. And, because silicone insulated motors pack more horsepower per frame size, mountings are smaller, less costly . . . installation problems minimized.



Simplified Enclosures Cost Less

Silicone insulated motors cost substantially less than other motors built for outdoor service. The reason: much lower enclosure costs because of "self-protecting" insulation systems made with Silastic, the Dow Corning silicone rubber. Specify open frames! There's no need for a premium priced enclosure to protect the insulation. Silicone rubber insulated open motors withstand torrential rains, hurricane winds, corrosive fumes, dust, snow, sleet, cold, heat . . . even flooding.



Send today for free brochure detailing how you can save with silicone insulated motors. Includes up-to-date list of manufacturers offering equipment insulated with Dow Corning Silicones.
Address Dept. 6917.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

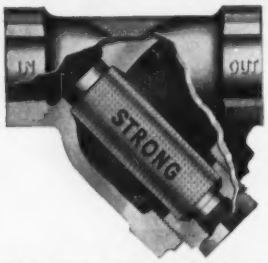
ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

cleaner steam systems... more positive regulation... use

STRONG

STRAINERS

Built-in preventive maintenance • positive protection against dirt and scale in a system • clog-free operation • quick, simple cleaning

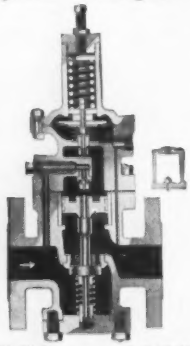


STRONG Strainers with threaded pipe connections: semi-steel (¼"-3"), cast steel (⅜"-2") and cast bronze (½"-2").

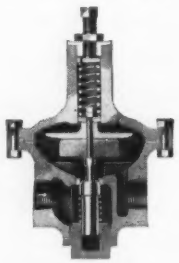
Flanged STRONG Strainers: semi-steel and cast steel (1½"-6"). Block Steel Strainers available for pressure to 10,000 psi.

REDUCING VALVES

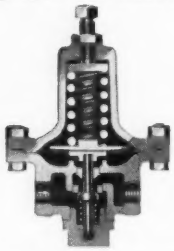
Accurate pressure control • simple adjustment • trouble-free operation • long service life • wide selection of types, sizes and pressure ranges • for use with steam, gas, air or water



Type "C" Valve: screwed (½"-1½") or flanged (2"-4") stainless steel trim, for 0-250 psi (semi-steel), 0-600 psi (cast steel).



Type "K" Valve: screwed (½"-1½"), built-in strainer, for pressures to 225 psi (semi-steel).



Type "O" Valve: screwed (⅛"-¾"), for pressures to 225 psi (semi-steel).

4/S

For complete information on these and other STRONG STEAM SPECIALTIES, contact your local STRONG Distributor or write for your copy of the new Catalog No. 69A today.

STRONG, CARLISLE & HAMMOND

508 Sandusky Street • Conneaut, Ohio

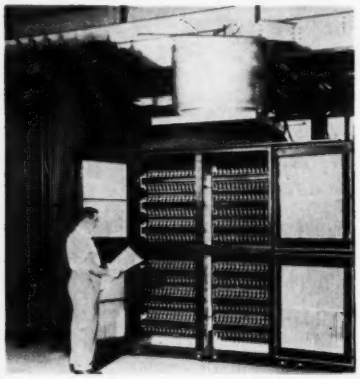
steam traps • air traps • float traps • F and T traps • vacuum or pumping traps • continuous blowdown valves • separators • engine stops

Reports from the field

Begins on page 162

builders. Used to heat asphalt and road oils in tank cars, original units were small oil-fired steam generators with engines to drive blower and oil pump.

A dairy in Wisconsin had a breakdown in its permanent boiler installation, and put in a portable boiler for temporary duty. They liked it, made it a permanent installation by taking off the wheels—and a new industry was born.



Silicon rectifier enters classified research

This unit will supply 3500-kw dc for classified work at University of California's Los Alamos Scientific Lab. Four 125-v rectifier sections can be connected in series and parallel combinations to give full power at 500, at 250 and 125 v. The advanced equipment provides current balancing, air cooling for high-altitude operation and low-ripple output through use of a 12-phase transformer arrangement. Input power is fed from a 13.8-kv 3-phase 60-cycle source.

New sources of energy surveyed by United Nations

Energy from the sun, the wind and the earth is covered in a report prepared for the U.N. Economic and Social Council. Report details developments to date and suggests an agenda for a future international conference on new sources of energy.

Direct conversion of solar energy to electricity by solar batteries and thermoelectric convertors is rapidly advancing. At a slower rate, work

Passes even the "white glove" inspection– Thanks to Dowell's new standard of cleanness

You may never have occasion to place "white glove" requirements to the cleanness of your process equipment, steam generators, tanks and piping. But, if you do need this high degree of cleanness, Dowell can now offer it — as an additional service — in the chemical cleaning of *your* plant equipment.

Dowell developed these new standards in cleaning the piping networks of the missile launching facilities at Cape Canaveral. Combining the research and engineering facilities of the entire company, Dowell perfected new techniques, materials and equipment to meet the necessary rigid specifications.

This new service is now adaptable for use in all types of American industry. For example, Dowell recently performed an intricate cleaning job on a 3½-mile-long buried pipeline. The customer wanted to convert the six-inch line from hydrocarbon gas to carry oxygen. For this pure product the line had to be immaculate—free of all foreign materials. The plant was faced with the alternate of laying new pipe—a six week job at a cost of $150,000.

Using their new standard of cleanness, Dowell cleaned the line of hydrocarbon residues, carbon black, grease, mill scale, and rust. Meanwhile, plant crews made mechanical alterations to the line at a cost of about $25,000. Dowell's charge was $20,000; the job was done in 3½ days.

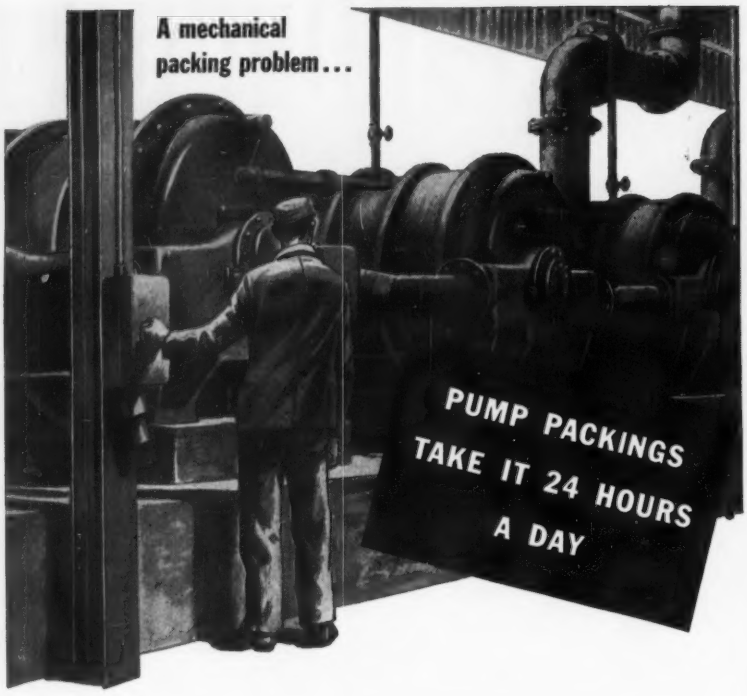
The job was satisfactory in every way. Inspection showed the line was free of all foreign matter. The customer credited Dowell with saving them about $100,000. Also the plant made additional profits because the line was put back into use so quickly.

Ask your Dowell representative about these new standards of cleanness and their possible application to your problems. This exclusive Dowell service may save you important money. Dowell, the pioneer of chemical cleaning, has 165 offices to serve every major industrial center. Dowell, Tulsa 1, Oklahoma.

Chemical cleaning service for all industry DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

For more facts circle 325 on Reader Service card, p 97

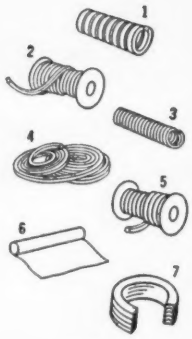


HOW AN R/M DISTRIBUTOR KEEPS PUMPS RUNNING, CUTS DOWNTIME, IN MAJOR PAPER MILLS

This large paper mill once used a braided asbestos packing on its centrifugal pumps moving strong and mild liquors. Pumps had to be purged every 3 months with a strong acid. This in turn called for repacking, at the price of heavy production losses. Then an R/M man recommended one of the Big 7, R/M No. 848 "Teflon"* filament packing. Costly downtime was eliminated as a result.

Solutions like this to difficult packing problems are routine to your local R/M distributor. As an added advantage to you, he carries large stocks maintainable by R/M warehouses strategically located throughout the U. S. His advice and his quality R/M products are as near as your phone. Write for name and address today.

*A du Pont trademark



THE BIG 7 PACKING TYPES

R/M's BIG 7 PACKING TYPES MEET 95% OF ALL PACKING NEEDS

R/M

BIG 7 PACKINGS
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, PASSAIC, N.J.
MECHANICAL PACKINGS AND GASKET MATERIALS

RAYBESTOS-MANHATTAN, INC., Mechanical Packings • Asbestos Textiles • Industrial Rubber • Engineered Plastics Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings Brake Blocks • Clutch Facings • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

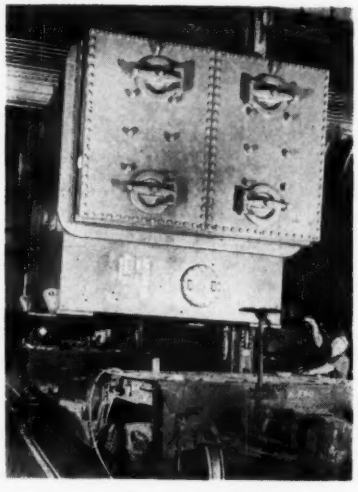
Reports from the field

Begins on page 162

proceeds on solar energy for steam production, air conditioning, refrigeration and water distillation. Cooling systems for livestock shelters in the U.S., ice-making machines based on absorption refrigeration in Russia and France, a helioboiler in Israel and solar reflectors to concentrate palm juice into sugar in Burma and India are some uses under development by world's engineers.

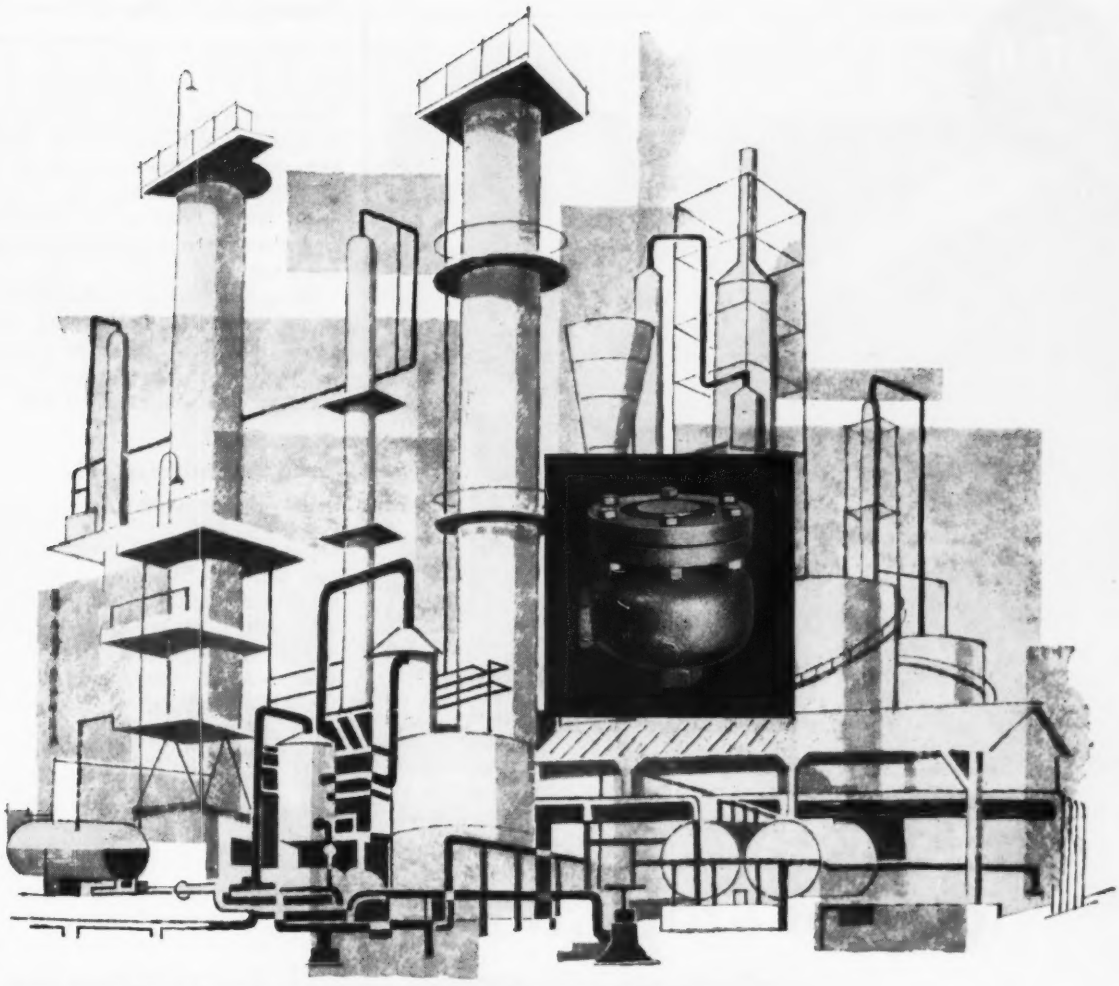
First modern wind-powered plants have already been installed in underdeveloped countries. Tendency is to use conventional propeller type machines with towers of minimum height. Wind-powered generators have been experimentally tied in with electrical networks in Europe.

In the past few years, production of electricity from geothermal power —natural steam and hot water—has started up in many countries. Two years ago only Italy had plants, but now both New Zealand and the USSR are producing electricity and Mexico, the U.S. and Santa Lucia in the West Indies are developing fields. Iceland plans to use her geothermic resources to distill sea salt and possibly to produce heavy water.



Nuclear-plant condenser is prepared for shipment

Argonne National Laboratory's Experimental Breeder II Station near Scoville, Idaho will soon receive this 16,000 sq ft 2-pass divided-waterbox condenser. Built at Allis-



THE ECONOMICS OF STEAM TRAP SELECTION

Initial cost versus installed cost

Everybody wants to save money in the purchase of steam traps, or anything else.

But a wise buyer will recognize that the *real cost* relates to the entire useful life of his plant, and that selection of the most efficient trap for a given application is an important consideration.

Compare the efficiency of Nicholson traps with that of so-called "bargains" and you'll see why plant engineers responsible for successful operation usually insist on Nicholson.

ST-102

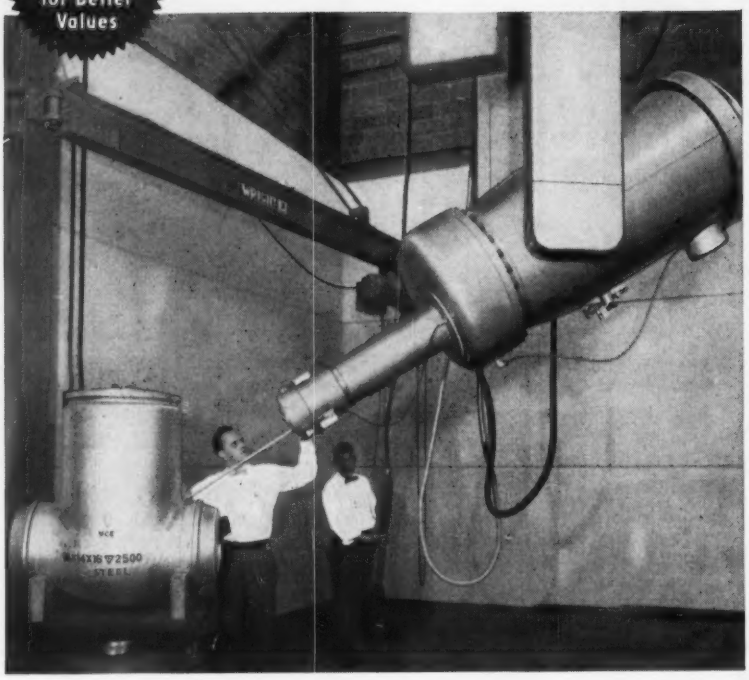
NICHOLSON

OF WILKES-BARRE

W. H. Nicholson and Co. • 10 Oregon Street • Wilkes-Barre, Pa.
Distributors in all principal cities

For more facts circle 327 on Reader Service card, p 97

ACCO
for Better
Values



We look thru steel for your protection

• The 2 million volt Van de Graaff radiographic X-Ray generator, shown above, was purchased by R-P&C to provide the positive Quality Control vital to the production of High Pressure Valves and Castings.

Supplemented with a 10 Curie Source of Cobalt 60, under A.E.C. license, this equipment is housed in a special building with walls of dense concrete 48 inches thick, necessary to contain the radiation.

Constant increase in Heat Temperatures and Pressures to which valves and castings are subjected, make relatively minor internal defects critical in many installations. Therefore, use of this X-Ray equipment is now an integral part of our inspection procedures. It offers another assurance of superior R-P&C valve quality.

Regardless of the severity of your service conditions, you can safely rely on the Quality and Dependability of R-P&C Valves. Your R-P&C distributor can supply you promptly with any of these valves including gate, globe, angle and check valves in bronze, electric furnace iron and cast steel, and forged steel; all in a wide range of sizes, styles and pressure classes. R-P&C also offers specialties such as Lubrotite gate valves, bar stock valves, asbestos packed cocks, cast steel fittings and pressure-seal cast steel valves.

R-P&C VALVES

ACCO

R-P&C Valve Division, American Chain & Cable Company, Inc.

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

Reports from the field

Begins on page 162

Chalmers' West Allis Works, the unit is equipped with double tube sheets to prevent condensate contamination. An automatic full-capacity steam-dump system keeps major electrical load changes from affecting reactor operation.

There are 3880 admiralty tubes—13 miles' worth—each 18 ft long, with 7/8-in. OD. Two condensate pumps, one motor- and one turbine-driven, are rated 530 gpm at 550-ft tdh.

Earnings higher in '58, utility executives told

Earnings of electric power companies were higher in 1958 than in '57, says J E Corette, president of Edison Electric Institute. Speaking to more than 1000 sales executives of the nation's investor-owned electric utility companies, Corette stated that while total corporate profits of all industries dropped 30% during the '58 recession, investor-owned electric companies grossed an extra $362 million; netted $107 million more than '57.

New construction reached an all-time high of $3.8 billion and year's record installation totaled over 14 million kilowatts. Wages and salaries rose about 5%.

A significant step was taken toward the goal of economic nuclear power with the formation last November of High Temperature Reactor Development Associates, Inc, composed of over 50 electric utility companies. This organization has offered to develop and build a h-t nuclear plant which may prove a short-cut to economic production of electricity from nuclear fuels.

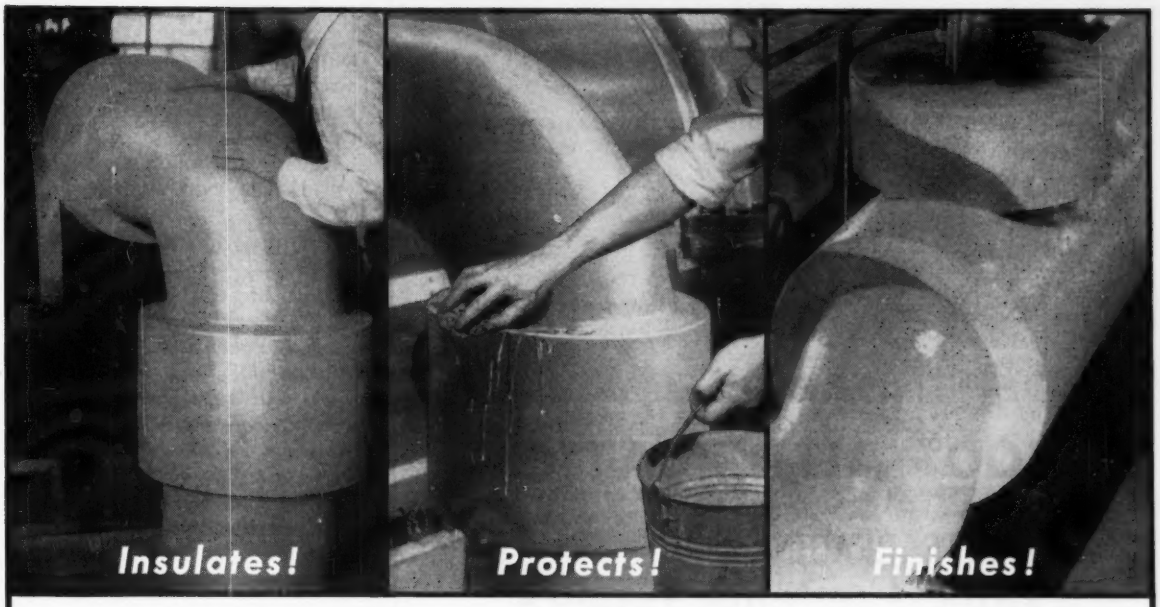
Old electrical equipment to go down in history

Outdated electrical equipment, the older the better, is being cataloged by the Electrical Historical Foundation, Box 93, Newfane, Vt. The Foundation wants to put all old equipment, on display, in storage or still in use, into the inventory. Anyone who knows of the location of electrical dinosaurs and dodos is asked to contact E S Lincoln, acting director of the Electrical Historical Foundation.

For more facts circle 328 on Reader Service card, p 97

1 QUICK APPLICATION INSULATES, PROTECTS, FINISHES!

EAGLE-PICHER
ONE-COTE CEMENT



- Saves time, work, money! One quick application provides smooth, light reflectant surface on hot or cold equipment!
- Clean, easy to handle! Just trowel it on—even on irregular areas where application of other insulations is often impractical.
- Highly efficient! Effective insulation at temperatures up to 1000 F.
- For outdoor installations! Quick-setting, withstands rain and moisture two hours after application. Prevents rust!
- For indoor installations! Requires no wire mesh or finishing treatment!

FREE SAMPLE!

Write today!

Prove to yourself, on your equipment, how Eagle-Picher One-Cote Cement can save you time, money and valuable man-hours.

Eagle-Picher produces a complete line of industrial insulations for all temperatures from below Zero to over 2000 F.

Since 1843

EAGLE EP PICHER

EAGLE-PICHER

The Eagle-Picher Company • General Offices: Cincinnati 1, Ohio

(*Member of Industrial Mineral Fiber Institute*)

For more facts circle 329 on Reader Service card, p 97

More than 100 International-LaMont HIGH TEMPERATURE WATER GENERATORS

(Total hourly capacity over two and one-half Billion Btu)

All of these users saved 15-18% in installation costs alone over comparable high pressure steam systems — and they are continuing to save 13-20% in operating costs and 50-60% in maintenance costs. These same savings can be yours.

INDUSTRIAL & COMMERCIAL
Douglas Aircraft Corp.
Continental Can Co.
Union Carbide Nuclear Co.
Behr-Manning Co.
Johnson & Johnson
American Airlines Inc.
Bethlehem Steel Co.
New York International Airport
Ohio National Life Insurance Co.
Trans-Canada Air Lines
Bethlehem Pacific Coast Steel Co.
International Min. & Chem. Corp.

HOSPITALS
N. E. Florida Mental Hospital, Fla.
The Children's Hospital, Ohio
Bronx State Hospital, N. Y.
Loring AFB Hospital, Me.

SCHOOLS & UNIVERSITIES
Rutgers University, N. J.
Hilltop Elem. School, Ohio
American River Jr. College, Cal.
Madeira High School, Ohio
Brigham Young University, Utah
Indian Hill Elem. School, Ohio
Holy Apostles School, Wisc.
Maple Park Elem. School, Ohio
Everett High School, Mich.
Avondale Elem. School, Ohio
Utica Jr. High School, Mich.
Whitewater High School, Wisc.
College of Great Falls, Mont.
The Colorado College, Colo.
St. Joseph Seminary, La.

Plus 21 U. S. Air Force and Navy Bases.

Get full details from your **INTERNATIONAL DISTRICT REPRESENTATIVE** or write for Bulletins 700 and 1000 today.

BOILER BUILDERS SINCE 1886

THE INTERNATIONAL BOILER WORKS CO.

Steel Firebox Heating & Power Boilers • Low & High Pressure Water Tube Package Boilers • International-LaMont Forced Recirculation Generators • ASME Code Pressure Vessels & Welded Products.

930 Spruce St. East Stroudsburg, Pa.

Manufactured in Canada by Canadian Vickers, Ltd., Montreal, P. Q.

For more facts circle 330 on Reader Service card, p 97

DEPENDABLE
100% AUTOMATIC
REMOTE READING
Tank Contents Gauges

- RELIABLE
- NO POWER REQUIRED
- UNDERWRITERS' APPROVED

Liquidometers use a temperature compensated balanced hydraulic system. Indications unaffected by changes in specific gravity. All models feature large easy-to-read dials. UL approved switches available.

Write for complete details to Dept. R.

Since 1920 ...of proven quality

THE LIQUIDOMETER CORP.
LONG ISLAND CITY 1, NEW YORK

For more facts circle 331 on Reader Service card, p 97

Appointments

Corporation changes

Sylvania Electric Products Inc: Rear Admiral F J Bell, USN (Ret.), senior vice-president, industrial relations. **Walsh Company:** A J Tomasek, chairman of the board and chief executive officer. **Yuba Consolidated Industries, Inc:** Ralph Cutler, vice-president; general manager of Southwest Welding and Manufacturing Div.

Gibbs & Hill, Inc: O W Kayser and P H Smith, assistant vice-presidents. **Stone & Webster Engineering Corporation:** F W Argue, executive vice-president. **Tobe Deutschmann Corporation:** J F Ferrante, vice-president. **Precision Transformer Corporation:** V M Prybyl, manufacturing vice-president. **Combustion Engineering, Inc:** Dr W H Zinn, vice-president.

Operations changes

General Electric Company, Silicone Products Dept: J T Coe, general manager. **Sylvania - Corning Nuclear Corporation,** Bayside facility: Dr A R Matheson, reprocessing manager. **Electronic Tube Corporation,** Oscilloscope Div: Max Schneiderman, engineering manager. **E Keeler Company:** Aaron Herzenberg, chief engineer.

Consultant changes

Ebasco Services Incorporated: F A Ritchings, consulting mechanical engineer. **General Electric Company,** Computer Dept: Dr D R Helman, consulting computer engineer, operations analysis. **Morton Salt Company:** R L Young, industrial water-softening specialist.

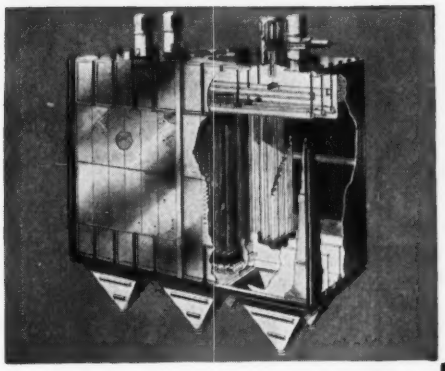
Sales vice-presidents

Ansonia Wire & Cable Company: John Marsh, industrial sales. **The Steelduct Company:** W F Zarbaugh. **Precision Transformer Corp:** Lee Butter.

General sales manager

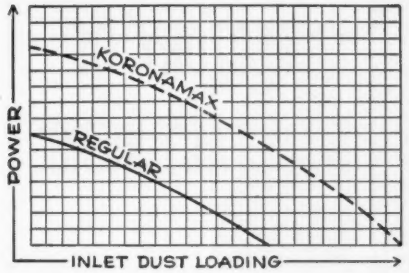
The Fisher-Pierce Co and **Sigma Instruments, Inc:** Philip Garnick.

continued

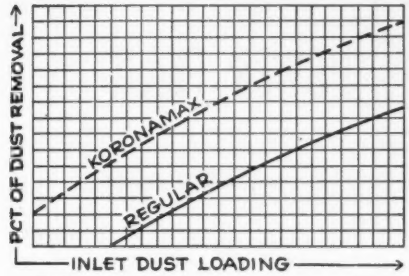


Another Koppers Exclusive in

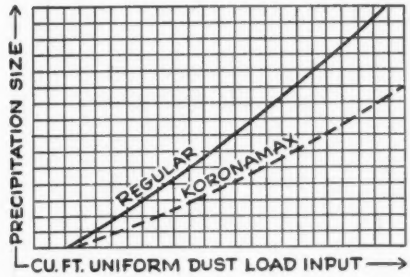
ELECTROSTATIC PRECIPITATION



INCREASED POWER—The evenly spaced discharge points of "Koronamax" Electrodes reduce the arc-over tendency and permit increasing power input.

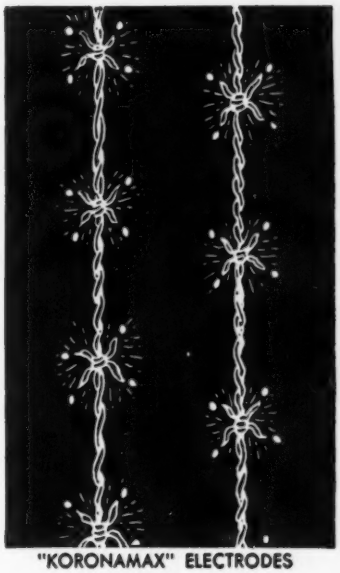


HIGHER EFFICIENCY—Replacement of regular electrodes with "Koronamax" Electrodes allows higher power input — greatly increased efficiency.



SMALLER SIZE—In new installations desired efficiency may be obtained with smaller unit when "Koronamax" Electrodes are used.

CONVENTIONAL ELECTRODES



"KORONAMAX" ELECTRODES

"KORONAMAX" ELECTRODES increase efficiency and capacity of electrostatic precipitators

"Koronamax" Electrodes developed by Koppers are now in service in several different applications and their *controlled* corona discharge has resulted in greatly increased capacity and efficiency. This unique type of precipitator electrode may solve *your* gas cleaning problem.

Koppers' experience, constant research and extensive field testing have led to this important advance in precipitator design. Check with Koppers to see if "Koronamax" Electrodes can help you get top precipitator efficiency. For more information, write: KOPPERS COMPANY, INC., 6505 Scott Street, Baltimore 3, Md.

KOPPERS

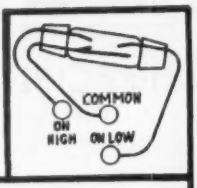
ELECTROSTATIC PRECIPITATORS

Engineered Products Sold with *Service*

For more facts circle 332 on Reader Service card, p 97

Three Operations One Control

MULTI-PURPOSE PRESSURE CONTROL



Single pole, cut in high (close on rise)

Single pole, cut in low (open on rise)

or Single pole, Double throw

PROVIDES

- **External Adjustments**
- **Repetitive Trip Point**
- **Repetitive Reset Value**
- **Visible Calibrated Dial**
- **Visible Contact**

Note Minimum Differentials for each Range

Adjustable Operating Range Psig	Maximum Momentary Surge	Min. Diff. Psig
0-30" Vac.*	30	2"
10" Vac. 12#*	30	1#
0-14#	30	1
0-20#	30	1
0-35	50	1¾
0-60	125	3
0-60	150	6
0-100	125	3¾
0-100	200	6
0-100	300	6
0-150	200	7
0-150	240	8
0-150	300	8
0-200	240	8
0-200	300	8
0-300	400	12
0-300	600	14
0-600	800	50
0-1000	1500	75

Series DA 20, 30, 50, 60, listed by UL and CSA

THREE CASE STYLES AVAILABLE
GENERAL PURPOSE (NEMA 1) Illustrated —for indoor use.
WEATHER-PROOF (NEMA 1A, 2, 3, 4,)— for outdoor use.
EXPLOSION-PROOF (NEMA 7)—for hazardous locations.

WRITE FOR CATALOG NO. 858
THE MERCOID CORPORATION
CHICAGO 41, ILL.

Appointments

Begins on page 180

Milwaukee Valve Company: D A Elert. **General Gas Light Company,** Humphrey Products Div: K S Hargie.

Hagan Chemicals & Controls, Inc, Controls Div: R E Blackwell, steel sales. **Henry Pratt Company:** H C Schwenk, manufactured equipment. **Fischer & Porter Company:** Doug Dismukes, water and waste industry manager. **General Electric Company,** Small Steam Turbine Dept: V P Purcell, industrial turbines.

Sperry Rand Corporation, Remington Rand Univac Div: Gordon Smith, industry marketing. **Carrier Corp,** Unitary Equipment Div; F E Purcell, packaged equipment.

Cook Electric Company: Clarence Wolfe, systems sales. **Burrell Construction & Supply Company:** C V Doherty, flyash sales. **Fairbanks, Morse & Co,** Electrical Div: C C Libby. **Walworth Company,** Plastics Div: Elo Blomquist. **The Cooper-Bessemer Corporation:** R L Spetka, power-engine sales.

District sales managers

Allis-Chalmers Manufacturing Company, Industries Group: B C Halsted, Richmond district. **United States Rubber Co,** Mechanical Goods Div: E G Morrill, Los Angeles; W E Larson, Denver; C A Driesch, Minneapolis.

OPW-Jordan: M D Payn, Rocky Mountain district. **The Okonite Company:** B T Bartlett, Syracuse, N. Y. **Chase Brass & Copper Co:** H N Hartman, Philadelphia. **Century Electric Company:** F L Beattie, Milwaukee.

Carlon Products Corporation: T W Kreiner, southwest region. **Harbison-Walker Refractories Company:** James Mitchell, Colorado. **Elliott Company:** F C Hohenstein, Chicago. **Fischer & Porter Company:** G A Stiftinger, Pittsburgh. **Dunham-Bush, Inc:** John Castello, Los Angeles. **The Fluor Corporation, Ltd:** L O Calkins, Western area.

Youngstown Sheet and Tube Company: C E Short, Minneapolis. **Goulds Pumps, Inc:** Lee Topp, New York City. **The Carpenter Steel Co,** Alloy Tube Div: E J Barcal Jr, midwest.

continued

Get your copy now . . .

THE "DIRECTORY OF MANUFACTURERS' AGENTS SERVING THE POWER FIELD"

. . . contains over 2600 listings!

The largest, most complete directory of its kind

$15.00 per copy

SEND YOUR CHECK OR MONEY ORDER TO:

George Keates,
Business Manager
POWER
330 West 42nd Street
New York 36, N. Y.

If steam costs give you

THAT FRUSTRATED FEELING . . .

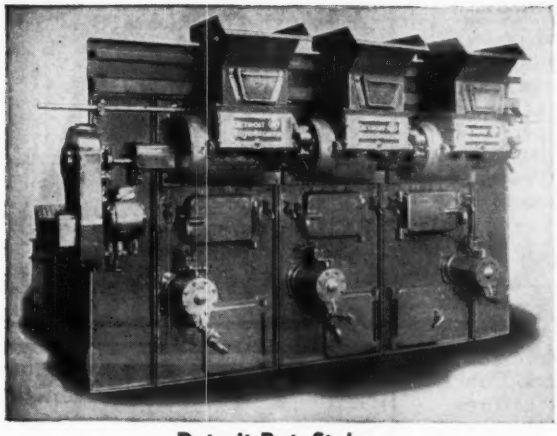
GET RID OF IT!

Modern DETROIT STOKERS under your present boilers will give you more steam at lower cost

If you can't get a new boiler plant you can still handle more load and reduce steam costs.

Many plants have done it by putting Detroit Stokers under existing boilers—to take advantage of improved combustion efficiency and higher burning rates. Savings and increased steaming capacities are substantial . . . are particularly worth while considering the moderate investment involved.

Let us show you the records of some of these plants. Investigation does not obligate you.



Detroit RotoStoker

One of the Detroit Stokers which will save you money. The line includes the LoStoker, UniStoker, Single Retort Stoker, Double Retort Stoker in the underfeed types . . . RotoStoker, RotoStoker Type CC (continuous cleaning) and RotoGrate Stoker (continuous ash discharge) in the spreader types.

There is a type and size of Detroit Stoker for any industrial or power need—3000 to 400,000 pounds steam per hour boiler capacity.

Detroit Stokers are available to burn all ranks of bituminous coals and lignites . . . and many waste and refuse fuels.

Our 60 years experience can be invaluable to you in selecting a type and size to meet your requirements.

Write for Bulletin.

Detroit Stokers cost less. Cost = initial investment + upkeep + production losses due to equipment outage. The total is less with Detroit.

COAL YOUR MOST ECONOMICAL FUEL

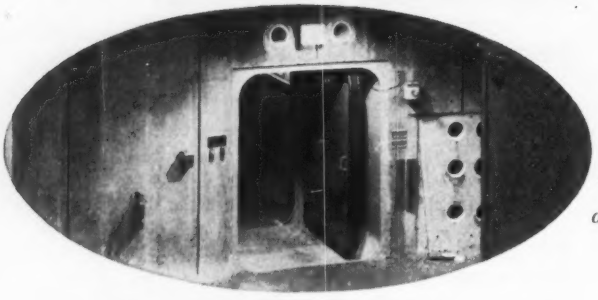
Most industrial plants are in areas where coal is the least expensive fuel. With Detroit Stokers it is by far the most economical.

DETROIT STOKER COMPANY

MAIN OFFICE AND WORKS • MONROE, MICHIGAN

District Offices or Representatives in Principal Cities

"push button" access locks eliminate human error



Henry Pratt access locks at MIT Test Reactor

Absolute integrity is assured any Nuclear Reactor Containment Vessel when Henry Pratt Co. Access Locks are provided. Completely automatic, these unique safety devices are interlocked so that entrance and exit to the vessel is accomplished with ease, in 25 seconds, with complete safety.

The knowledge and experience gained through installations at Vallecitos (GETR), Arco (EBR-2), M.I.T. (test reactor), Ispra, Italy (CNRN) and others, has enabled the Henry Pratt Co. to offer a complete line of standard sizes for both personnel and equipment in high pressure and low pressure design.

Among exclusive Henry Pratt Co. Access Lock features are:

1 Inflatable Seal Personnel Air Locks. Either round or rectangular. Only one second is required to inflate or deflate the seal from readily available plant air supply. Emergency inflation can be provided by standby nitrogen tanks or air reservoirs. Push button actuated, only proper sequence of buttons will operate doors. Eliminates error. Flush-floor doors for easy passage of personnel or hand-trucks. Features pressure equalizing valves which prevent radical pressure changes within lock.

2 Inflatable Seal Equipment Locks. Design provides 8′ x 10′ opening. Flush mounted doors permit use of full area for equipment passage. Features pressure equalizing valves which prevent radical pressure changes within lock.

3 Compression Seal Personnel Air Lock. High pressure design up to 45 psia. Rectangular 3′-6″ x 6′-8″ passage. Conforms with ASME non-fired pressure vessel code. Features pressure equalizing valves which prevent radical pressure changes within lock.

The Henry Pratt Co. is also a pioneer in the design and manufacture of butterfly valves and expansion joints for the Nuclear Industry. A competent group of sales engineers are located in key cities. In Europe, represented by Ateliers J. Hanrez, Societe Anonyme, Monceau-sur-Sambre, Belgium.

Bulletin **451K,** *soon to be published, fully explains these and many other advance features of the 25 standard sizes available in fully automatic or manual design. Be sure to write for your copy today.*

HENRY PRATT

Henry Pratt Company, 2222 S. Halsted St., Chicago 8, Ill. Representatives in principal cities

For more facts circle 335 on Reader Service card, p 97

Appointments

Begins on page 180

New district offices

Joy Manufacturing Company, Industrial Div: at 1420 Walnut St, Philadelphia; R H Schlobohm, manager. **Ladish Co:** Rm 1010, 211 N Ervay Bldg, Dallas, Texas; W F Brockwell and R O Barlen in charge.

Engineer changes

C Stellarator Associates: R E Fickes, J C Louzader. **North American Aviation, Inc,** Atomics International div: Dr Marvin Fox. **Bechtel Corporation,** Power and Industrial Div: T A Lang, executive engineer. **South Dakota State College:** M L Manning, dean of engineering.

Recent moves

Dorr-Oliver Incorporated: all filtration engineering and development operations to Stamford, Conn. **Manning, Maxwell & Moore, Inc:** relocation of nuclear-products dept at Watertown, Mass; electronic process-control dept to Stratford, Conn. **Clayton Manufacturing Company:** Cincinnati headquarters to 3051 Exon Ave, Evendale, Ohio.

New names

Gulton International Div: reciprocal sales organization for Gulton Industries, Inc. **Koyo-Seiko Company** of Japan: will distribute bearings in U.S. through International Ball and Roller Bearing Corporation.

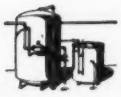
Recent purchases

Combustion Engineering, Inc: acquisition of General Nuclear Engineering Corporation. **American Metal Products Company:** purchase of Davis Engineering Corp.

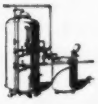
Awards

Dr C F Kettering, noted inventor, engineer and industrialist, was posthumously awarded the American Institute of Electrical Engineers' Edison Medal for 1958.

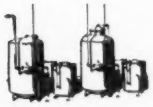
Dr Ghaffar Farman-Farmaian, Tehran, Iran: winner of the 1958 Alfred Noble Prize Paper Award.



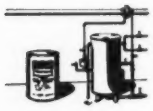
ZEOLITE WATER SOFTENER — manual and automatic. Up to 44% more soft water output from a softener of given size.



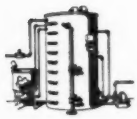
ULTRA-DEIONIZERS — produce highest quality mineral-free water. Replace distillation methods at fraction of distillation cost.



DEALKALIZATION & ION EXCHANGE SYSTEMS—Dealkalizers to control alkalinity. Ion Exchangers to produce water of any desired quality.

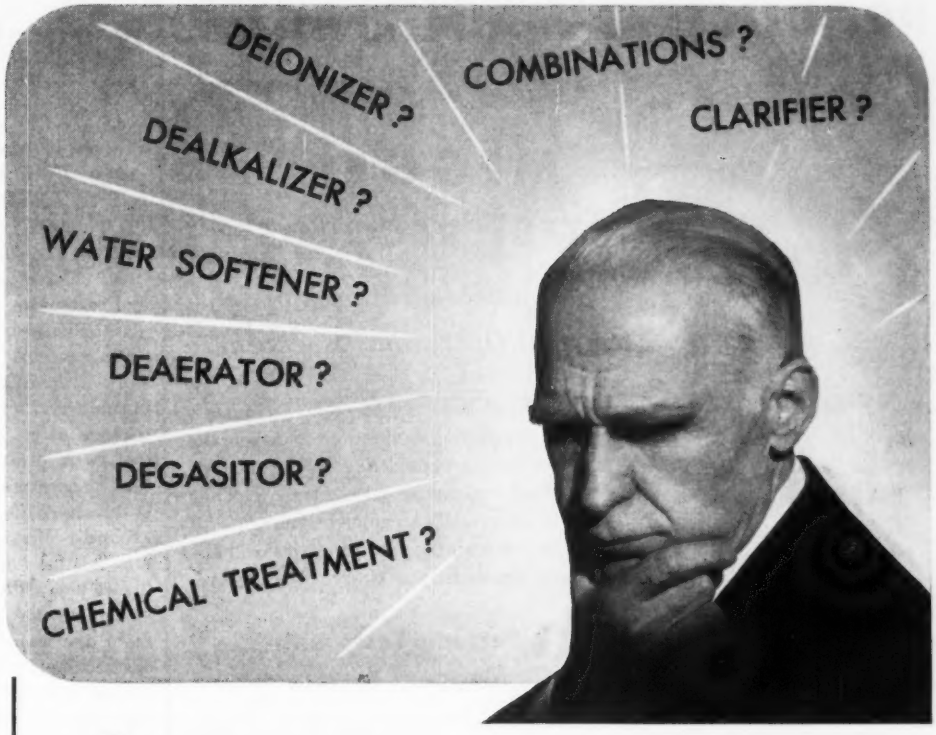


CHEMICAL TREATMENT SYSTEMS—prevent scale, corrosion and depositions with Elgin specially formulated chemicals.



CLARIFIER—for removing excess alkalinity and solids for clarification of turbid waters.

DEGASITORS—for removal of entrained gases from water by aeration.



Confused about your water problem?

It isn't surprising that you should be confused about your water conditioning problem when you think about the almost endless ways of solving it that are being thrown at you from all directions in these fast moving times.

But instead of being confused, you should be happy that there *are* so many new roads open! Actually the confusion arises from the many new developments in water conditioning that have been crowded into recent years. And this is all to the good . . . for it means that today you can find a far, far better answer to your water problem.

Yes, your only basic problem is to sort out the one best way of meeting your particular needs from all the ways and means available today. This is the all important problem, but we have the answer to that one too: Simply take your set of conditions to a firm like Elgin—an organization that for more than fifty years has travelled all the roads of water conditioning—opened many of them. Out of Elgin experience will come the best, the most economical solution to your problem.

NEW 24 PAGE BULLETIN

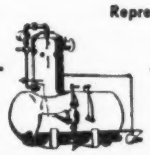
All the up-to-the-minute facts about Elgin equipment and service (briefly highlighted here) are covered by a new Bulletin 615 just off the press. It shows how Elgin experience — made available through your Elgin representative — can give you the one best answer to your problem.

Write for your copy!

ELGIN SOFTENER CORPORATION

130 No. Grove Avenue, Elgin, Illinois

Representatives in Principal Cities *In Canada: G. F. Sterne & Sons Ltd., Brantford*



DEAERATING HEATERS—supply make-up water pre-heated by exhaust steam in which CO_2 and oxygen are eliminated.

WATER FILTERS—Diatomite, sand, anthrafilt, activated carbon and oil removal filters in all types and sizes.

ELGIN
WATER CONDITIONING
SINCE 1908

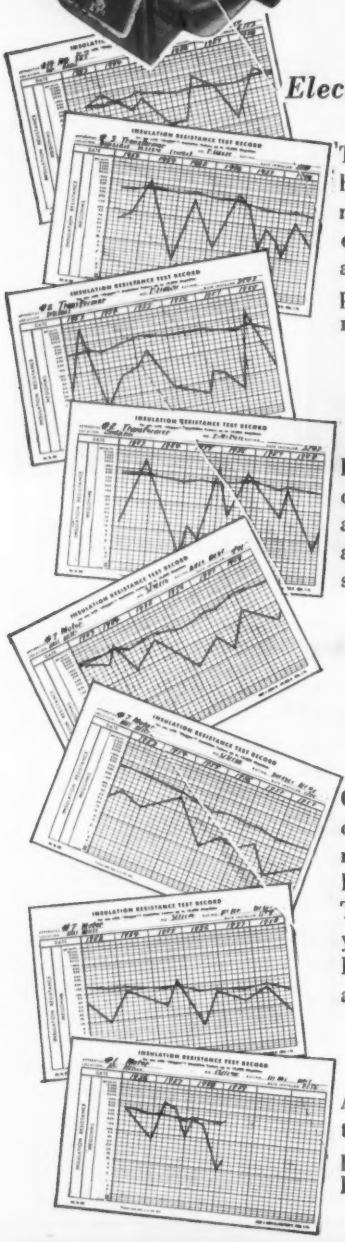
For more facts circle 336 on Reader Service card, p 97

PRODUCTIVE MAINTENANCE

based on Accurate

MEGGER®
TEST RECORDS

. . . an integral part of
Electrical Operations Everywhere



Throughout industry Megger Instruments have earned the distinction of being the most widely accepted devices for making electrical resistance measurements. They are the universally accepted instruments for preventive maintenance programs and the regular maintenance of electrical equipment.

Periodic Tests with Megger® Testers

By their periodic use, and from the records of their measurements of the insulation in all important equipment, trouble may be anticipated and avoided, and production stoppage and losses reduced.

BIDDLE PRACTICAL TECHNICAL ASSISTANCE HELPS MAKE PRODUCTIVE MAINTENANCE POSSIBLE

Over forty years of experience in the field of electrical testing is represented in the manuals, bulletins, and other technical literature published by the Biddle Company. These are some of the extras you get with your purchase of a Megger Instrument. Practical engineering assistance is always available without obligation.

WANT PRACTICAL HELP?

A collection of reference material designed to be helpful in setting up and interpreting a practical testing program may be had for the asking—request File 21 -P.

8906

JAMES G. BIDDLE CO.
1316 ARCH STREET • PHILADELPHIA 7, PA.
ELECTRICAL TESTING INSTRUMENTS • SPEED MEASURING INSTRUMENTS
LABORATORY & SCIENTIFIC EQUIPMENT

Bookshelf

Electrical Maintenance and Repairs. *By E M Watts. 324 pp, illust, 21 shillings, net. Cleaver-Hume Press Ltd, 31 Wright's Lane, Kensington, London W 8*

Mr Watts has written a detailed and extensive manual on electrical maintenance, including chapters on setting up a maintenance system, equipment required, records, etc. Specific information is given on maintenance of wiring installations, control gear, protective equipment, motors, generators, welders, etc. There is an especially thorough chapter on ground protection and tests. Numerous helpful illustrations have been drawn especially for this book.

The manual is, of course, written from the point of view of British electrical practice, and frequent reference is made to British standards and codes. This does not greatly interfere with its usefulness to American readers, however.

Air Pollution Laboratory Methods Manual. *Looseleaf, $12.50. Los Angeles County Air Pollution Control District, 434 S San Pedro St, Los Angeles 13, Calif.*

Detailed descriptions of more than 15 methods used in laboratory analysis of samples are contained in a bench-sized volume. The methods covered have been selected, developed or refined by the Los Angeles District since its organization 11 years ago.

Book is principally prepared for technicians working in air-pollution research and control. Additional methods can be added to the looseleaf book as published, and will be available at $1.00 each.

Nuclear Engineering Handbook. *Edited by Harold Etherington, Vice-president, Nuclear Products, Erco Division of ACF Industries. 1857 pp, 706 illust, 552 tables, 6¼ x 9¼, cloth, $25.00. McGraw-Hill Book Co, Inc, 330 W 42nd St, New York 36, N. Y.*

Here we have the first handbook that covers the nuclear power field from a practical and theoretical standpoint in one volume. Seventy specialists contributed to the 14-sec-

for complete...sure...permanent...low cost

UNDERGROUND HOT PIPE PROTECTION

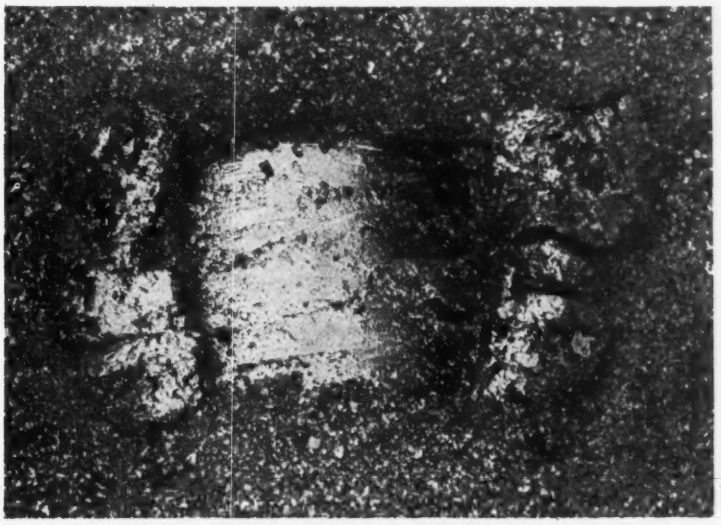
Specify and Use.....

TRI-SUL-ITE

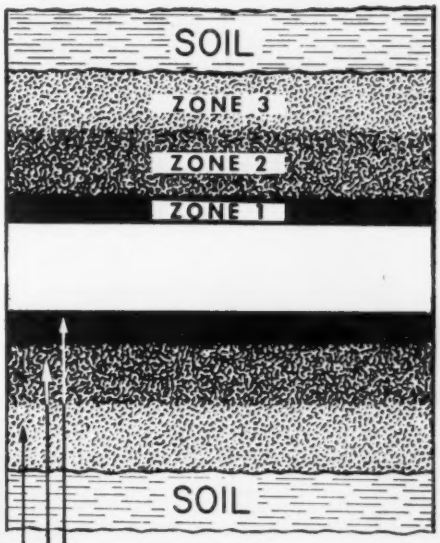
3-WAY PROTECTION SYSTEM *

THE ZIEGLER GILSONITE MINERAL

Looking for an underground piping system that's free from excessive heat loss...yet gives the greatest protection possible from corrosive soil conditions? A system with a low installation cost and minimum maintenance expense? Then TRI-SUL-ITE 3-way protection system is your answer. TRI-SUL-ITE installations have proven to be the speediest...easiest...surest underground pipe protection. TRI-SUL-ITE, a specially selected gilsonite, is poured under and around all pipes in the trench. After proper curing, it forms three zones of protection against water, corrosion and heat loss.



Close-up photo illustrates the plastic zone of TRI-SUL-ITE peeled back to show excellent adhesion for pipe protection.



***ZONE 1 PROTECTION: PERMANENT WATER BARRIER**

The first zone of TRI-SUL-ITE adjacent to the pipe, fuses from pipe heat into an impermeable, waterproof coating. It resists normal soil acids and alkalis. When it is plastic the pipe movement is contained within this zone. The first zone of TRI-SUL-ITE protection gives positive assurance that water cannot follow the grade of the pipe.

*** ZONE 2 PROTECTION: EXCELLENT INSULATOR**

The second zone consists of the edges of the TRI-SUL-ITE granules fused to isolate the air spaces, resulting in a highly effective insulator which minimizes heat losses to the soil.

***ZONE 3 PROTECTION: INSULATOR AND WATER BARRIER**

The third zone of TRI-SUL-ITE granules is not fused by heat and provides maxium insulating efficiency plus good resistance to water penetration and protection against surface shocks and subsoil stresses.

Write for complete literature.

ZCO

G. S. ZIEGLER & COMPANY

GREAT NECK, N. Y.

Agents in Principal Cities Throughout the United States and Canada.

MINES: "CASTLE PEAK," "LITTLE BONANZA," "LITTLE EMMA"

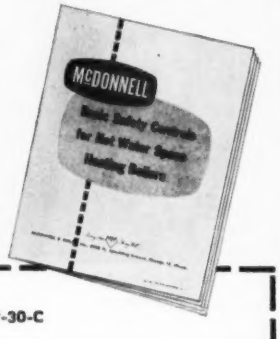
For more facts circle 338 on Reader Service card, p 97

NEW BOOK THAT CAN DO A JOB FOR YOU!

Covers the WHY and HOW of Basic Safety Controls for Low Pressure Steam Boilers

Here is a book that deals in brass tacks solely. It tells its story in simple diagrams and equally simple explanation that wastes no words on product description. It sticks to fundamentals and concrete recommendations that answer practically all safety control problems encountered in the low pressure steam field. So well classified and indexed are the facts that, whatever your job, you can turn right to the most authentic way of handling it: The right product . . . the correct hook-up . . . the proper wiring. *Use the coupon to request your copy*, and if you do not have the earlier "hot water" booklet, request it too.

This new "Low Pressure Steam" booklet was inspired by the widely praised booklet on "Hot Water Boilers." These two companion-pieces can do a real job for you.



McDONNELL & MILLER, *Inc.*,
3506 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

McDONNELL

Boiler Water Feeders • Low Water Fuel Cut-Offs • Pump Controllers • Flow Switches • Relief Valves • Related Liquid Controls for Tanks, Stills, Air Conditioning Systems

☐ Send me your new STEAM Booklet L-711
☐ Send me your new companion HOT WATER Booklet P-30-C

Company Name_____

Street Address_____

City Zone & State_____

By_____

Mail to: McDonnell & Miller, *Inc.*, 3506 N. Spaulding Ave., Chicago 18, Ill.

For more facts circle 339 on Reader Service card, p 97

tion handbook. Four major categories are covered: (1) basic data for reactor engineering (2) formulas and methods for designing reactors (3) present state of the technology and (4) condensed descriptive reviews of nuclear theory, engineering principles.

The 14 sections of the book cover: mathematical data and tables, nuclear data, mathematics, nuclear physics, experimental techniques, reactor physics, radiation and radiological protection, control of reactors, fluid and heat flow, reactor materials, chemistry and chemical engineering, nuclear-power-plant selection, mechanical design and operation of reactors, isotopes.

Technical Societies Guide. *32 pp, 8½x11, $3.00. Industrial Publicity Association, Technical Societies Committee, Room 1616, 41 E 42nd St, New York 17, N. Y.*

Procedures required by technical societies and trade associations for preparation and presentation of papers are listed in this guide. The book was designed as a reference for engineers and industrial publicists, giving specific procedures for formal presentation of technical papers.

Prepared in cooperation with 36 technical societies, the guide covers membership structure, meeting dates, subjects of interest, requirements, mechanics of contribution, publication policies. Suggestions on content, fundamentals of oral presentation and visual aids are included in a special section.

Thermodynamics for Chemical Engineers, 2nd edition. *By Harold C Weber and Herman P Meissner, Professors of Chemical Engineering, Massachusetts Institute of Technology. 507 pp, illust, tables, 6 x 9¼, cloth, $8.50. John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y.*

This book intends to serve both the engineer and the physical chemist, and of course this includes the working area of the chemical engineer. This edition offers many examples of application of principles, an improvement over the first edition.

The book is intended for both first and postgraduate courses in thermo-

For more facts circle 340 on Reader Service card, p 97 ➤

How many spare parts should you stock per pump?

"You may be *over*stocking," says Phil Olmstead, *Chief Engineer*, Goulds Pumps, Inc.

"There are many times," one plant manager told me recently, "when we have a *higher* inventory of spare parts than the people we buy from!"

No laughing matter, this—many plants today are faced with the difficult problem of keeping stocks *adequate*, yet keeping inventories *down*. If your problem is *pump parts*, you can do both—by *interchangeability!*

For instance, take the Goulds Fig. 3405 single-stage centrifugal. You can get it in 33 sizes, with 66 combinations possible, considering right- and left-hand rotation. *Just 3 groups of parts fit all 66 combinations of this pump!*

That means that, for every three to five pumps of a given group size (sizes are divided up three ways into "small," "medium," and "large" groups), we can recommend that you stock just one shaft, one set of bearings, sleeves, mechanical seals or packing. *In short, all parts are interchangeable except casings, casing covers and impellers!*

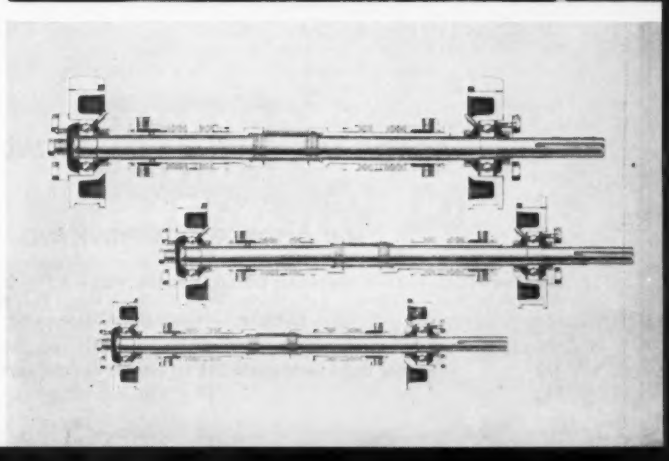
How much can that cut down your inventories? You figure it out—*one* set of group parts for as many as *five* pumps, where you might expect to stock one for each. *Three* groups for *thirty-three* different sizes of pumps—a *91% cutdown!*

And here are three more advantages to consider:

1. You can make changes *in the field* to meet new needs.
2. You receive off-the-shelf delivery of parts you order.
3. Initial cost is lower due to standardization in manufacture.

The next time you talk to a Goulds representative, ask him to show you how interchangeability works in our Fig. 3405 . . . and in the rest of our line, too. If you want information right away, drop a line to me, Phil Olmstead, at Goulds Pumps, Inc., c/o Dept. PO-59, Seneca Falls, N.Y. I'll see that you get all the information you want.

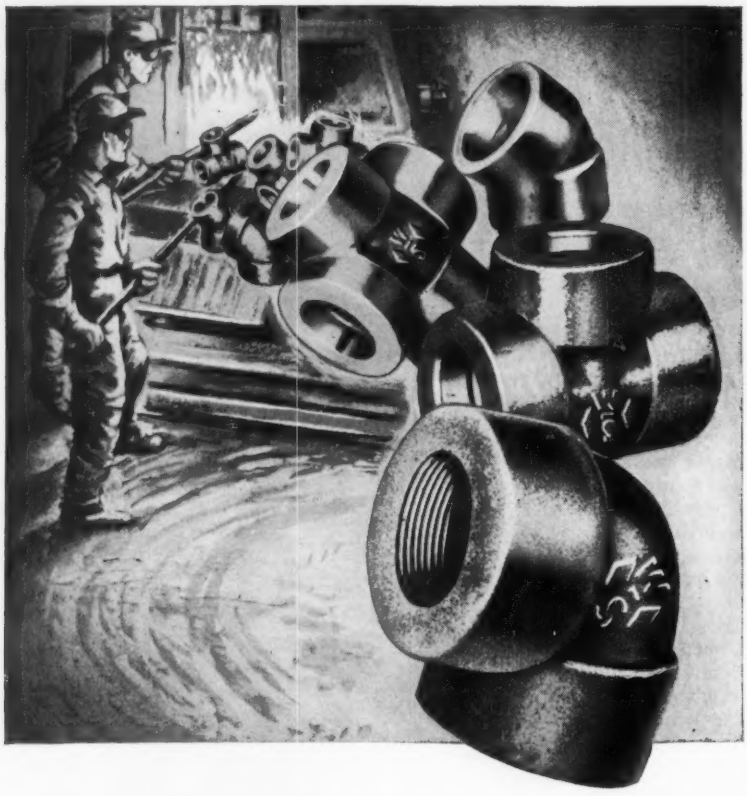
GOULDS GP PUMPS



Just three groups of shafts, sleeves, bushings, glands, packing, ball bearings, bearing shell, end caps, closures and gaskets for Goulds Fig. 3405 pump to fit all 33 pump sizes.

Drop Forged from Solid Billets...

FORGED STEEL FITTINGS



Heat . . . pressure . . . turbulence . . . oxidation . . . vibration . . . reduction . . . shock. For critical installation problems like these, get maximum protection with W-S Carbon, Stainless and Alloy Steel Fittings.

- Drop forged to produce exceptionally high tensile and impact strength.
- Long accurate threads, in perfect alignment, for ease of installation.
- Heavy uniform fitting wall thickness—an important safety factor.
- Accurate machining to fit tight.

For your next order, call your nearby W-S Distributor. You'll find him ready with comprehensive stocks of the complete line of W-S high-quality fittings. *Forge & Fittings Division, H. K. Porter Company, Inc., Box 95, Roselle, New Jersey.*

FORGE AND PORTER FITTINGS DIVISION

H.K. PORTER COMPANY, INC.

Divisions: Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Mouldings, National Electric, Refractories, Riverside-Alloy Metal, Thermoid, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

Bookshelf

Begins on page 186

dynamics for chemical engineers. The mathematics uses partial differentials and emphasizes the physical aspects quite strongly. The treatment of thermodynamics of power services is quite brief compared to that usually found in books devoted to engineering thermodynamics.

Handbook of Industrial Loss Prevention. *By Specialists of the Factory Mutual Engineering Div. 960 pp, illust, tables, 7¼x9⅞, $20.00. McGraw-Hill Book Company, 330 W 42nd St, New York 36, N. Y.*

Experts in protection show how large and small companies have cut plant losses by thousands of dollars, guarding against fire, explosion and other hazards. Lightning protection, anchoring your roof against wind, designs for minimizing earthquake hazard are covered.

Data included was originally prepared for the private use of company engineers, and has not been generally available in book form. Charts, tables, diagrams provide the answers to most questions—from specific details such as adequate hose sizes, to explosive characteristics of industrial chemicals and metallic dusts.

Standard practices for low and medium-speed stationary diesel and gas engines. *220 pp, $5.00. Diesel Engine Manufacturers Association, 2000 K St, NW, Washington 6, D.C.*

The fifth edition (1958) of DEMA *Standard practices* has a new name and subject material to include gas engines as well as diesels and dual-fuel engines. A new chapter discusses chemical aspects of gases, fuel consumption formulas and plant layout for gaseous fuel systems.

Four chapters are now in accordance with latest appropriate standards: (1) governors — AIEE-ASME committee specifications (2) lube and (3) fuel oil characteristics—ASTM standards and (4) generators and electrical equipment—ASA standards and standards of NEMA.

Additional data in other sections reflect latest trends in use of superchargers and turbochargers, residual fuel oil heating and cleaning and large power-plant layouts.

How C. H. Wheeler condenser design provides optimum deaeration and REDUCES STATION MAINTENANCE

An informative advertisement from one of the nation's most experienced condenser manufacturers

The problem of power plant steam system maintenance involves many things including cleaning the water and steam sides of condenser tubes, tube damage caused by impact of water in exhaust steam, tube abrasion resulting from sand or grit in the circulating water, tube plugging resulting from foreign matter in the circulating water, and deposits in the boiler.

One of the most important ways to reduce station maintenance requirements is to improve deaeration. Excess air in condensate results in corrosive oxide deposits in the boiler which decrease its efficiency. During 56 years of condenser design and manufacturing, C.H. Wheeler has developed a number of ways to produce deaerated condensate *in the condenser*. In special designs, they maintain oxygen content of less than 0.01 cc. per liter. Oxygen levels of far less than 0.01 per liter are often achieved in C.H. Wheeler Condensers, depending upon the amount of air leakage of the system and the amount of contaminated returns.

Basic causes of oxygen and other non-condensable vapors in condensate are system leaks, heater returns and make-up water.

Full deaeration of make-up water requires bringing it up to the temperature of the steam, so that the condensate is 100% saturated with water vapor and all gases have been driven from solution. However, to be sure that no gases are mechanically entrained in the droplets of water, the water must be agitated thoroughly to permit release of any remaining air bubbles.

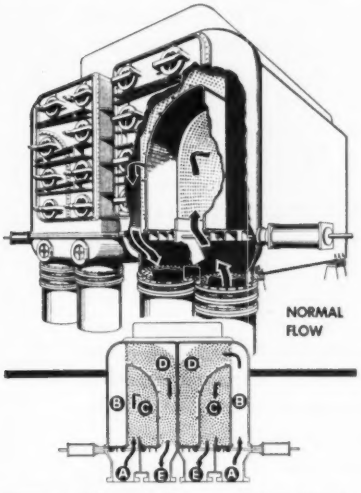


Figure 1: Schematic diagrams of C.H. Wheeler Reverse Flow.

In C.H. Wheeler Condensers, normal make-up water is heated to steam temperature and agitated to release non-condensables by spraying it over the top of the tube banks at both ends of the tubes, and out of the path of high-velocity steam from the turbine exhaust. Steel bars above the tubes protect them from water impingement damage. Heater drips are sprayed in the steam lanes to permit flashing and release of entrained gases.

Condensate is cascaded over deaerating bars (1, in Figure 2) in the presence of a moving blanket of steam, to provide proper agitation and reheating before it is drained into the hotwell. The Tubejet® Air Ejector (3) draws off non-condensable gases through the air-vapor suction line (2), and discharges them to the atmosphere. Central location of the air cooler section reduces depth of steam penetration and resistance to steam passage, achieving a new low in condenser pressure loss.

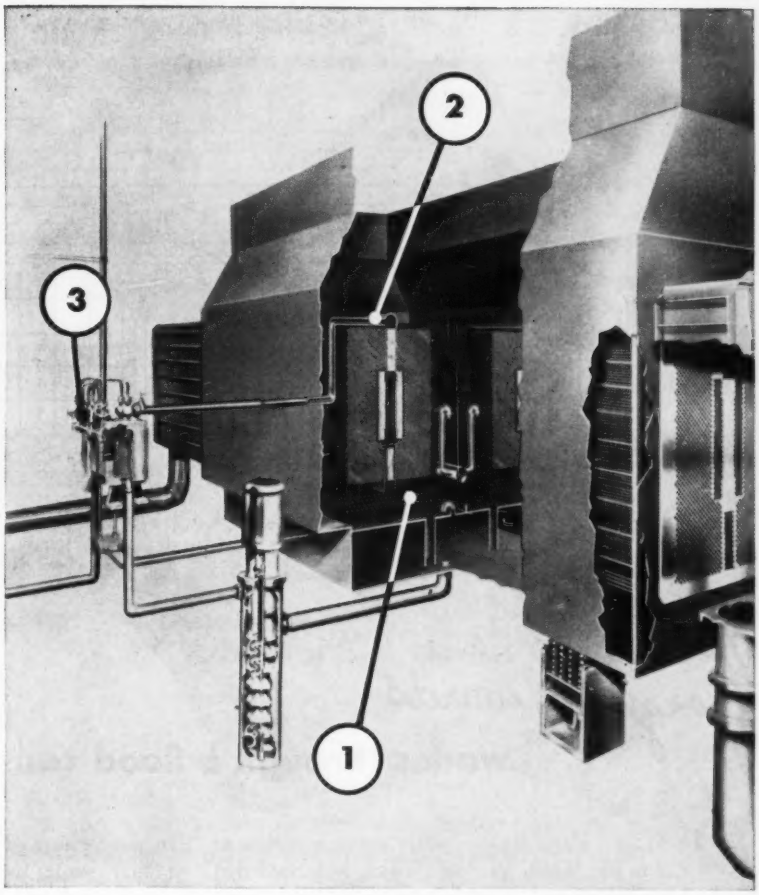


Figure 2: Cutaway drawing of portion of C.H. Wheeler Dual Bank, Divided Water Box Condenser.

Another Big Problem—Tube Cleaning

If your water supply is polluted, condenser tube deposits may become troublesome. There are several ways to correct this situation: Shooting small slugs through the tubes with high-pressure water, using acid and chlorinating the circulating water, among other methods.

One method particularly successful in removing algae, and foreign matter such as twigs, leaves and scale, is Reverse Flow (see Figure 1). Developed by C.H. Wheeler, it makes possible the flushing of tubes and sheets without shutting down the condenser.

Here's how Reverse Flow works: Normal operation is shown on the left. Water enters through inlet A with right inside port open, flows through tube bank C to the rear of the condenser. It returns through tube bank D to the front of the condenser, and then it discharges at E.

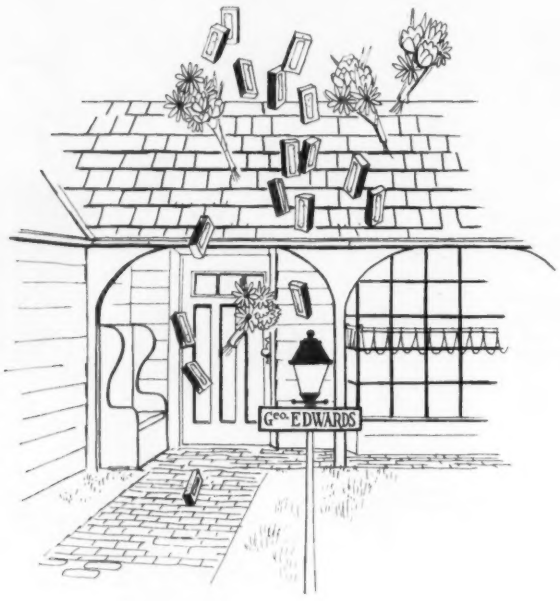
The right side of the diagram shows Reverse Flow in operation in a C.H. Wheeler Dual Bank, Divided Water Box Condenser. Water enters through A with outside port open, flows up through channel B and through tube bank D to rear of condenser, returns through tube bank C to front of condenser and discharges at E. Reversing can be accomplished during full load operation and full flow of circulating water, without additional pressure loss. Sluice gates for each half of the condenser move on a common stem. Each half can be back-flushed independently; or both halves can be back-flushed simultaneously with one or two circulating pumps operating.

C. H. WHEELER MFG. CO.

19th and Lehigh Avenue • Philadelphia 32, Pennsylvania

Whenever you see the name C.H. Wheeler on a product, you know it's a quality product.

Steam Condensers • Steam Jet Vacuum Equipment • Centrifugal, Axial and Mixed Flow Pumps • Marine Auxiliary Machinery • Nuclear Components



George Edwards wades through a flood caused by low water

In writing about the low-water cutoff situation as I did in the March issue of POWER, I realized that I was dealing with a subject of much controversy. Even so, I wasn't quite prepared for the flood of mail that poured in to me and to Lou Rowley's office. Letters from equipment manufacturers (EDITOR'S NOTE: *see* Comment, *page 78, for excerpts)*, boiler-insurance company inspectors and boiler-service and repair men all said, in effect, that I was absolutely right in pinpointing lack of maintenance as the basic reason for low-water cutoff failures. With a few exceptions, however, they differed with my views on the real value of a second cutoff. Chances of both units failing at the same time even with practically no maintenance, they said, are not 50-50 but at least a hundred to one. Well, who can say? Personally, I feel that if neither unit gets any maintenance it's a case of "if winter comes, can spring be far behind?"

A few people felt that I had no business sticking my nose into the situation at all and hinted darkly that I was a boil on the posterior of progress. "From your viewpoint, a seaworthy ship wouldn't need more than one lifeboat," said one. Another said, "what is wrong with applying the doctrine of 'second chance' to boiler safety?"

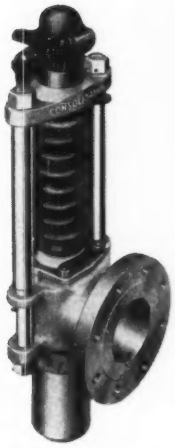
A boiler-burner service-company manager wrote, "your article is a restatement of the good-practice concept long recommended by engineers—just take care of the equipment and all will be fine. Well, I'm not so sure. I'm not particularly a proponent of dual cutoffs as a means of providing greater safety, but I believe the idea has merit. Having been connected with boiler-burner service for some 27 years, I'm prepared to state that no equipment is so good that it will never fail. Manufacturers of safety equipment tell the world that their product is just about perfect, but much is far from that."

Here we have suspicion pointed at the equipment itself, rather than at my boy—the guy who's too lazy or ignorant, or both, to follow a few simple rules to prevent destruction of a boiler. I can't buy the poor-equipment story. And I think the majority of you will agree with me.

By and large, however, the volume of mail is a healthy sign regardless of whether it supports or lambastes what I said in March. It's healthy because it proves that a tremendously irritating situation is getting a lot of attention from a lot of people. And when this happens we're on the way to solving a problem. I'll admit freely that a second low-water cutoff can't help but improve a boiler's chances of survival under lamebrain maintenance. It's possible, too, that a second cutoff could be a spur to improved maintenance of both units. It may bring their importance into sharper focus as the operator realizes that he can't have dual protection unless he takes care of *both* units. But I can't retreat a step from my belief that the *basic* reason for a second cutoff is a sad commentary on maintenance.

STOPS VALVE LEAKAGE

at high pressures



Consolidated "Maxiflow" Safety Valve, Type 1700 Series, Sizes: 1½" thru 6".

The Thermodisc Seat in Consolidated "Maxiflow" Safety Valves solves the problem of valve leakage at high pressures, saves steam and reduces maintenance.

Research has shown that when a safety valve on high pressure service reseats after popping, a small amount of leakage occurs momentarily between seat and disc before the valve seals off and becomes tight. This leakage is comparable to steam flow through small, individual orifices.

When a small steam leak exists at some point on the valve seat, the area near the point is cooled by the refrigeration effect of the escaping vapor. The metal tends to contract causing slight deformation of the seat. This acts to increase the gap size between disc and seat bushing at the leakage point. The size of the gap increases rapidly until the rate of leakage becomes extremely high.

The Thermodisc Seat prevents seat distortion and consequent leakage with a seat element recessed to form a thin wall at the area of seat contact. This design permits a high rate of heat-transfer in the metal *that eliminates all thermal differences.*

The result is a degree of tightness, essential to the operation of safety valves in high pressure services, never previously achieved. For complete details, write for Bulletin 707B.

MAXWELL MANNING M&M & MOORE INC. TRADE MARK

CONSOLIDATED SAFETY VALVES

A product of

MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Stratford, Connecticut
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

For the first time!

Everything you need in Dial Thermometers for Piping and Duct work!

A new and complete line of instruments: Dial thermometer of Marsh precision and accuracy designed down to the last detail for piping and duct work . . . for use on heating and cooling equipment, air ducts, vessels and kilns, ovens and similar applications.

Easier to read

Illustrations tell the story. Four types, seven ranges—72 stock combinations to meet every condition. Big, legible 3½ " and 4½ " dials . . . easy to read in places where piping and duct thermometers must be installed. Ease of reading further increased by provision for tilting and turning dials to any desired reading angle. Line includes distant reading types that take care of remote locations.

Unbreakable—more accurate

Instead of fragile difficult-to-read glass tube thermometers you now have sturdy, unbreakable, legible Marsh Dial Thermometers. Guaranteed accurate to plus or minus one division of the scale, they have far greater *readable* accuracy than any glass tube type. All have the famous Marsh "Recalibrator"—to *keep* them accurate.

All purpose

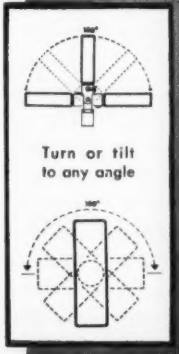
Design provides for every on-the-job condition. Separable sockets ("wells") simplify installation—or removal for servicing. Extension necks take care of insulation on piping or ducts. Long stems in duct type put temperature-sensitive section where it belongs.

Note the brief specifications opposite. Any thermometer is available from stock.

Write for bulletin telling the whole story.

Jas. P. Marsh Corporation
Dept. F, Skokie, Illinois

Marsh Instrument & Valve Co. (Canada) Ltd.
8407 103rd Street, Edmonton, Alberta



For piping

Dial sizes: 3½" and 4½"

Ranges:
0° to 100°F for chilled water
20° to 120°F for condenser water
40° to 240°F and 100° to 300° for hot water and domestic water

¾" NPT connection

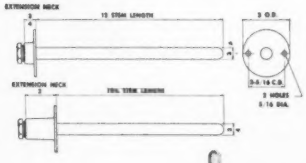
All ranges, in both direct mounted and remote reading types, available with three standard sockets shown in drawing below.

For ducts

Dial sizes: 3½" and 4½"

Ranges: —40° to +120° F
0° to 160° F
0° to 220° F

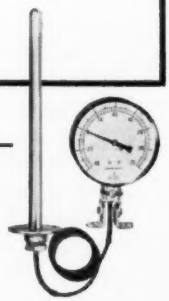
All ranges, in both direct mounted and remote reading types, available with standard extension necks and stems shown in drawing below.



MARSH
DIAL THERMOMETERS

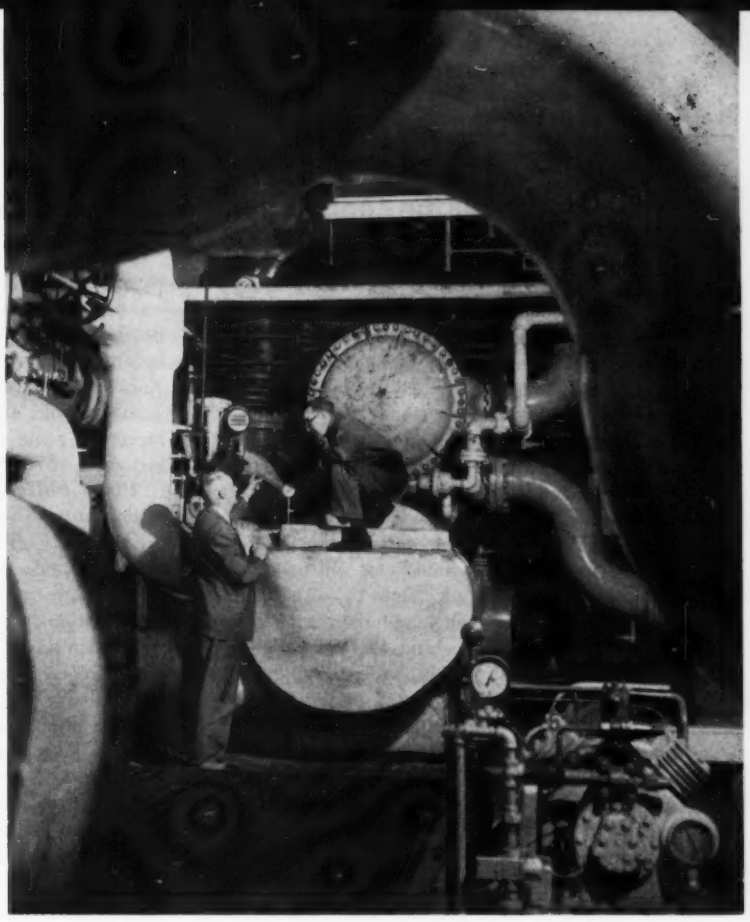
Also remote reading—

Piping and duct thermometers of same basic design available with 6 ft. of capillary tubing as shown.



Plant maintenance and management section

STEVE ELONKA
Associate Editor in Charge



"Set up clear-cut channels for gripe communication . . . and make them known to all plant men"

Licking plant politics . . .

. . . can be a toughie for the young engineer in his first managing spot. Staff opportunists can undo a superb job of training, but fast. Here are the facts on recognizing the problem plus practical steps toward eliminating it

By ROBERT M PECK
Personnel Consultant

Once you step into an engineering management spot, the problems you carry home at night are often the type that defy a slide-rule solution. The technical decisions necessary in everyday engineering are often a breeze compared to problems involving the feelings, ambitions and attitudes of those on your engineering staff and the mechanics down the line.

As an engineer you are equipped to tackle knotty power-service problems and lick them. But there may be little in your past experience or schooling that qualifies you to recognize and cope with problems involving people.

Stepping for the first time into a management spot means many things to

"... be concerned with the doings of a staffer who swings for

the younger engineer. The move does not always indicate he is the most capable technical man on the team. It does generally mean he has a sound engineering background plus the potential to handle the many and varied management problems that crop up every day. One of the toughest he will find is the occasional need to cope with a plant politician who may be a step or two removed yet whose actions he is responsible for. Too many engineers, although quite confident in their professional achievements, admit confusion and ineffectiveness when confronted with evidence that a plant politician is at work. But when the facts are undeniable you will have to face up to the problem and take quick steps to solve it.

Personal gain rather than long-term company benefit is the motivating force behind the plant politician. Sure, there's nothing basically wrong in striving for personal gain unless it is done in a way to harm the plant staff as a whole. We're not writing here about the buttering-up-the-boss type of politician. We are concerned with the staffer or mechanic who deliberately strives for a higher step on the ladder at the personal expense of another man on the team and to the eventual high cost of the company as a whole.

Marks of a politician—the type of guy who can do real harm to staff morale and company productivity—are many. Out of the myriad of ingenious variations, we list here but a few of the "classifications." Although the distinctions seem reasonably well defined, keep in mind there is considerable overlapping and blurring in practice. One misdirected fellow may use several tactics on one or more people at the same time. And since others on your staff are doing their best to cope with the situation you, removed from the scene of operations, may be getting confusing backwash.

Gossips create doubt in the minds of many about Tom Smith's ability by consistently reporting or reconfirming his problems and apparent failures . . . even though it's not their responsibility to do so. Typical: "By the way, did you know that . . ." The gist may be an "amusing" little incident that deftly pegs Tom as slow-witted, a little too sharp or some other unwanted characteristic. Still others will pass on to you the morsel, "it's too bad Tom can't seem to get along with his immediate boss." Tom, in fact, may be a pretty good worker.

Opportunists plant suspicion in your mind as to Tom's real motives, place artificial limits on his abilities, maneuver him into a blunder or the appearance of one. They may casually mention to you, "I wonder why Tom . . ." and bring up an exaggerated failing (like gambling) that they know you are strongly opposed to. Or they may compare Tom's work with theirs, carefully limiting the comparison to their strong points and successes and forgetting to mention Tom's virtues.

Another favorite amongst some is rigid adherence to instructions, even when such will lead to production loss and put Tom in a bad light.

A foreman who reports to you may be maneuvering his own political boat. It's not unknown for a supervisor to waste a Tom Smith's time on wild-goose-chase projects and in the next breath accuse him of poor productivity. A twist on this is overpraise to the extent that it becomes impossible for Tom to live up to expectations. Another angle is the supervisor's practice of keeping Tom's visible ability well below his own level. These represent some actions of misdirected men who have lost sight of staff teamwork and a joint goal.

Plant bully counts on the average man's reluctance to do battle. The typical gambits are to outshout, cut off or brusquely dismiss Tom's ideas, arguments or whatever. The effect is to hold a hand over Tom's mouth, ridicule him into submission, or make him clam up in exasperation. In another twist, the troublemaker will imply familiarity with you so that cautious Tom may be afraid to talk frankly.

Keep well in mind though that some men are just naturally a little rough and aggressive in their dealings with others. They may have no conscious intent of harm.

Pirates on your staff are certainly not difficult to spot when they brazenly appropriate ideas or grab credit for Tom's work. But how about the lad who skips his foreman and comes directly to you saying, "Since Tom doesn't like to. . . ." If you go along without reasonable investigation you may well chop off the chunk of Tom's responsibilities he wants most. The same type guy may give Tom private support on a proposal, then reject it publicly when the matter comes up at a staff meeting.

Sure, this may have been a case where Tom missed the boat quite honestly. But the abrupt turn-about-face by a co-worker can seriously affect Tom's efficiency in the future unless you handle the situation skillfully.

Recognizing the problem is your first responsibility. Too often key men ignore the problem of politics, minimize it or underestimate it. The "not-here" extreme says "I guess it does go on in some companies, like big corporations, but not here." The cost of not recognizing the problem can be measured in many ways. Consider these possibilities: the loss of productivity when tensions and dragging uncertainty bog down key men in key departments; all the investment in painstaking selection and training of a staff partially lost when essentially capable people—like Tom Smith—are demoralized, quit, or become just a cut above being worthless by lapsing into submission or dogged retaliation. Consider the losses to a plant when an individual's activities on any level are dictated by personal ambition without regard to the effect on others.

What to do? Keep your eye open for a possible series of unpleasant but apparently unrelated incidents. Give the matter your full attention. It calls for a willingness on your part to take the time to dig out the facts and set matters straight. Even when just one of your staff is at fault, others must suffer and defend themselves to some extent. Not knowing proper defenses, they might well adopt the same deplorable tactics under the general heading of protection, starting a morale-killing vicious cycle.

If you believe the trouble source is a single man, call

the next rung on the ladder at the direct expense of another..."

him into your office. Stick to the facts and lay the problem on the line. Leave the lad with a crystal-clear picture of why he's really doing himself harm. Let him know you won't tolerate further nonsense. Remember you respect and trust the man who says exactly what he means, who doesn't beat around the bush. Encourage this bluntness and honesty; practice it yourself.

If you feel there are several involved, call in your foremen for a briefing. Make it clear you are aware of the problem. Make sure they're alert for trouble signs.

As a final step you may have to face your responsibility and fire the man or men causing the trouble. It's tough. But when you weaken, consider the awful heartbreak one troublemaker can bring to honest and conscientious men and their families.

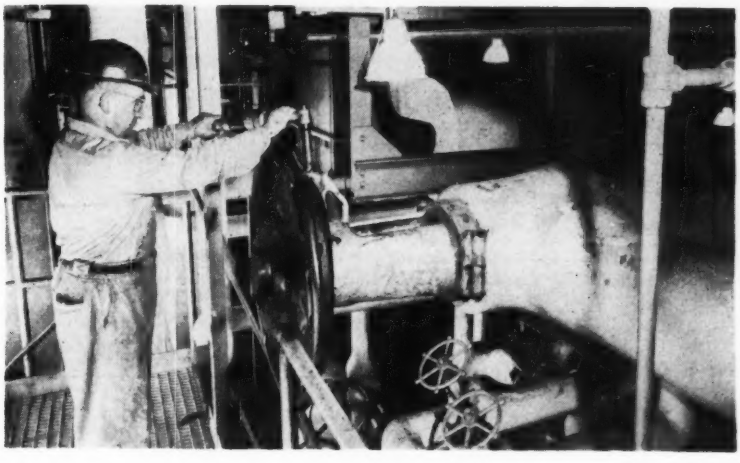
Removing the cause may require more than simply ferreting out those causing the upheaval. Actually, you too may be a contributing cause simply by allowing poor management practices to exist. What are some of the conditions that encourage plant politics? Poor handling of gripes is one. All too often there is no clear-cut path for bringing an unsatisfied gripe to your attention, or to *your* boss. Set up clear channels of gripe communication and make them known to all plant people. This simple step will pinpoint men who make it a practice to bypass their immediate superiors.

On this matter of gripe communication, keep in mind there should always be an open-door policy on your part for the lad who feels he is not getting a fair shake on the supervisor or foreman level. Be sure to hear him out.

Open jobs are another invitation for the plant politician. Once again a straightforward approach is your best bet. Clearly indicate what job requirements are and state who, by position and experience, is not eligible.

Other factors contribute to encouraging an overly ambitious plant politician. Fuzzy areas of responsibility and authority serve as a major temptation for the unscrupulous. Any vagaries in operating policy pose another lure plus an alibi for your man if confronted.

Finally, never forget the value of regularly leaving your office to stick your nose into plant doings where your men are concerned. Make it a habit to stroll through the plant at unexpected times, swapping comment with your men—engineers, foremen, mechanics alike.



Boiler-feed 10-in. valve closed in 2½ minutes by one man using portable air power

First boiler-feedline valve using a portable power source has been placed in service at the E F Barrett generating station of the Long Island Lighting Co. The 10-in. 1500-psi steel angle stop valve is on the discharge side of the boiler-feed pump. Six more will be installed to complete conversion of all of the station's feedwater valving to air operation.

Made by Edward Valves, Inc, air-operated unit lets one man shut valve in 2½ min compared to conventional 40-min period with two men working. This includes running stem from full open to full close with the air operator, then impact tightening by hand.

Air wrench takes power from 100 psi station compressed air. Flexible hose connects air line and air wrench. One hose will serve three air-operated valves at the Barrett station. Another hose will serve the four valves on h-p feedwater heaters.

Air-operated device has two components: (1) a standard handwheel with ring gear added to underside (2) a standard valve bonnet with a pinion gear attached by means of a welded bracket. Pinion transmits power from a standard air wrench through ring gear in wheel to valve stem in sharp contrast with the commonly accepted practice using permanent electric-motor operators.

First conversion at the Barrett Station required four hours. However plant manager M E Marshall feels all later conversions can be made in about half that time. First valve was converted while associated feedwater circuit was operating at 2500 to 3000 psi—valve was merely backseated. Remaining six valves will also be converted to air under pressure.

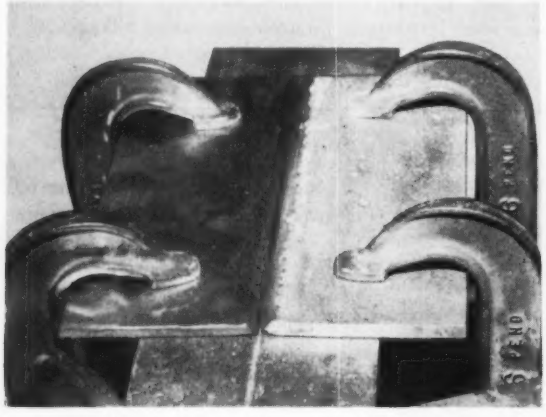
OPERATORS' NOTEBOOK **129**

Now you can weld copper

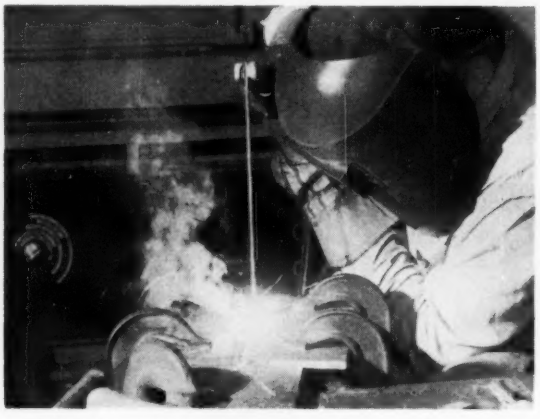
Step-by-step procedure shows you how

1 After beveling both the copper and Type 347 stainless steel to provide 80-degree included angle, preheat the copper specimen to 1000 F. Copper here is ⅜-in. thick

2 Overlay the copper using 5/32-in. nickel electrode. Use four overlapping beads



4 Position the Type 347 stainless steel with the copper to allow a root spacing of ¼ in. Then tack both ends of the joint



5 Run in the root pass; follow beads alternated between sides and middle root. Current is 200 amp, electrode is 3/16-in. dia

Need for welding copper to stainless is growing

Welding copper to stainless steel has always been a difficult problem. A firm knowledge of this joining process is even more important today because of: (1) the increasing amount of welding in the nuclear energy fields and (2) the greater number of special applications where you must combine the strength and corrosion resistance of stainless steel with the electrical conductivity and corrosion resistance of copper.

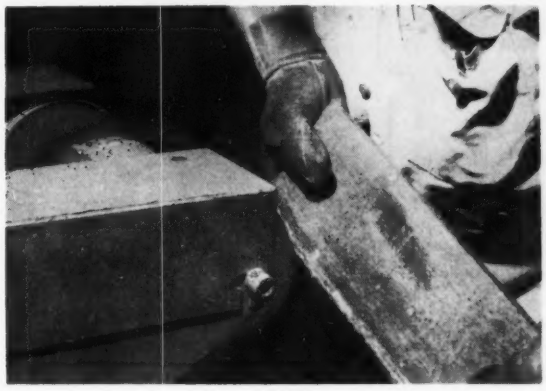
One good way to weld a piece of ⅜x12-in. Type-347 stainless steel to copper of the same size is shown by the step-by-step photos above. You can get equally good results using metal arc, TIG or MIG processes. Welding materials used are International Nickel Company "141" coated-nickel electrode, AWS:A5.11-54T (Class E4N11) for metal arc and "61" nickel wire and rod for the MIG and TIG processes, AWS:5.14-56T (Class ERN61).

Joint design for welding copper to stainless steel is the same as for welding any other dissimilar metals. Start by beveling the copper and Type-347 stainless-steel pieces to give an included angle of 80 degrees. Use a U or double-V joint for thicknesses over ⅜ in. U grooves should have a 3/16 to 5/16-in. root radius and a 15-deg side angle. A ½-in. root radius with a 15 to 25-deg side angle is recommended for J grooves.

Clean each piece thoroughly after beveling and preheat the copper with a torch set to 900 to 1000 F, Fig. 1. Overlay the beveled edge with four overlapping stringer beads. Use a 5/32-in.-diameter "141" nickel electrode, Fig. 2. Chip each bead and wire brush to remove slag and cuprous oxide. Current for the job shown was set

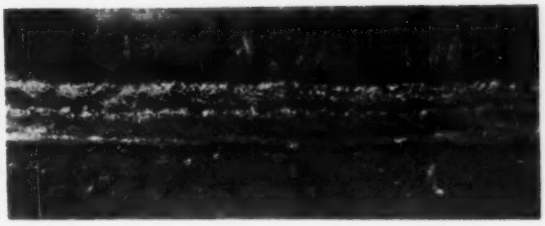
to stainless and mild steel

STEVE ELONKA, Associate Editor

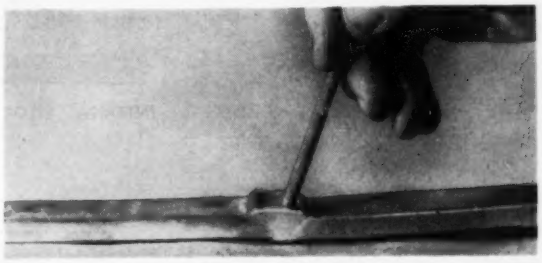


3 Restore 40-deg bevel after 3/16-in. overlay has been applied to copper. Use straightedge to make sure bevel is even, true

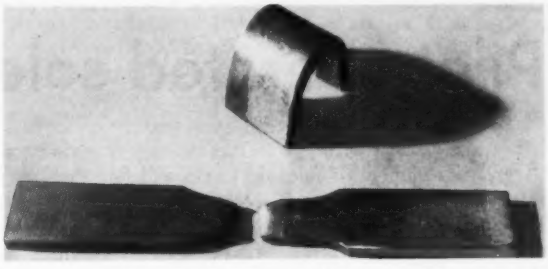
6 Chip out slag and wire brush to remove all foreign materials and cuprous oxide. This is important before final weld



7 Close-up of final weld shows an even contour, good fusion and penetration. Copper is on top. Type-347 stainless is on bottom



8 Etching and macroexamination of a cross section of finished weld show no porosity, cracking, fissures, slag entrapment



9 Longitudinal bend test proves no failure—weld is strong and sound. In short-gage tensile test copper broke at 33,200 psi

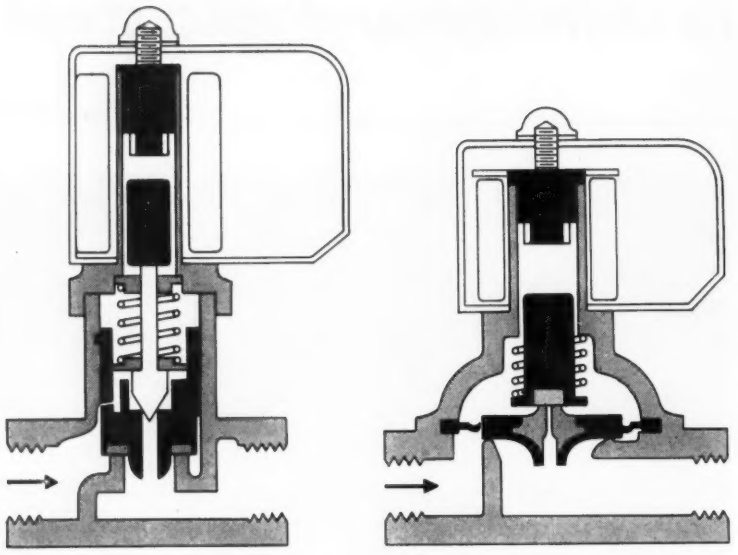
at 120 to 125 amp dc (reversed polarity). In any case use only enough amperage to obtain proper arcing characteristic that minimizes dilution of overlay with base material. Method illustrated produced a 2-layer overlay about 3/16-in. thick. Two layers are needed because dilution in the first layer runs as high as 25%. With two layers of overlay-weld material the copper dilution in outer layer is kept low enough so it won't cause embrittlement in the finished weld. It's important that you extend overlay well beyond each edge of bevel on the copper. This eliminates contact between weld metal and copper when combining the dissimilar joints.

After applying the nickel overlay to copper, clean, then grind to restore the 40-deg bevel. Use a straightedge to make sure overlay is true and even, Fig. 3. Next, place the stainless steel and nickel-overlayed copper on a copper backing bar to control penetration. Clamp the pieces about ⅛ in. apart at root of the bevel. Then tack weld both ends of the joint, as shown in Fig. 5, using a 3/16-in.-diameter "141" nickel electrode. Current is increased to 200 amperes for this operation and for rest of the job without preheating.

Make a complete root pass. Clean the weld bead after each pass by wire brushing, Fig. 6. Lay beads on alternate sides of the V and in the middle, following a regular pattern, until the V is filled, Fig. 7.

When welding the V take care to stay within the area of the nickel-overlay weld metal. Contact with portions of the copper not covered by the overlay causes poor fusion, undercutting and weakening of the weld.

By F E REEVES
Automatic Switch Co



INTERNAL PILOT relieves pressure above port, letting supply pressure open valve. Piston, *left*, or diaphragm, *right*, have bleed ports to balance pressure during closing

With more solenoid valves slated for heavier duty in tomorrow's plants you'll find this series a practical reference on types, application and operating tips. This month we cover . . .

Pilot-operated solenoid valves

A growing number of solenoid valves will find their way into main lines and control circuits in tomorrow's plants. Part I in this series (March 1959, pp 202-203) dealt with direct-acting 2-way valves. All the valves described in that article were for low-pressure low-capacity applications. However, in the higher-pressure or larger-capacity region, the basic operating principles of the valves often change. For example:

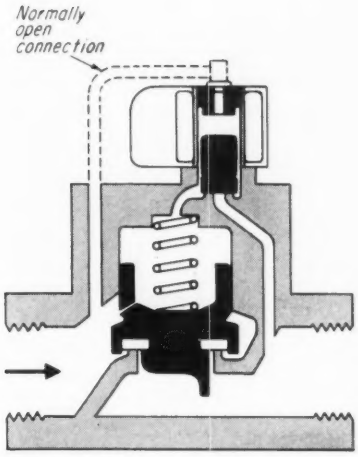
When port sizes are over ¼-in. and pressures several pounds or higher, direct-acting valves cannot ordinarily be used because of the limited force available in the solenoid. Action is then only triggered electromagnetically, and either line pressure or an auxiliary pressure operates the valve through a pilot action.

Internal pilot-operated type, above, left, has been used extensively, but is now being superseded in the smaller sizes, from ⅜ to 1 in., by the diaphragm type, above, right. However, the operating principle is essentially the same.

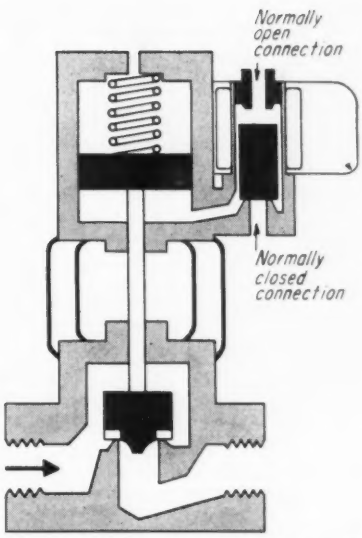
Both types are still packless construction and the solenoid, when energized, opens a pilot port. Flow of gas or liquid through the pilot port relieves pressure above the piston or diaphragm and line pressure opens the valve. Pilot port diameter must be larger than bleed port through the piston wall or diaphragm so there is a constant tendency toward lower pressure above the piston or diaphragm. In addition, the diameter of the piston or diaphragm is larger than main port, which also helps to multiply the force available for opening the valve.

Diaphragm rides, after opening, on the pressure drop through the body because of friction and turbulence. If the pressure drop is sufficient, the valve will remain in the fully open position until de-energized. If pressure drop is insufficient because of backpressure or drop in line pressure to a very low value, valve will partly close. Differential of from three pounds in the small sizes to five pounds in the larger sizes is usually sufficient to maintain the diaphragm in the fully open position. Obviously, such valves cannot be used where line pressures are five pounds or less since line capacity would be limited.

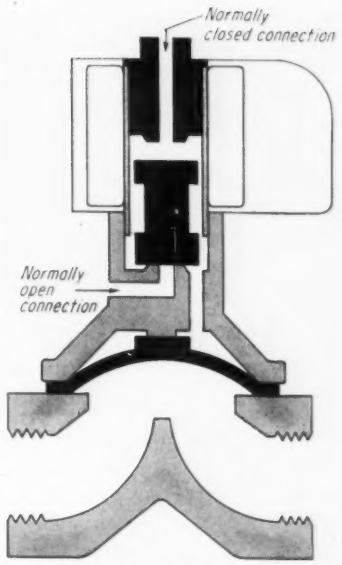
Piston-operated valves are of two types. The value shown above, left, provides a direct connection from the solenoid to the piston, and where pressures are low, solenoid is strong enough to open the valve without assistance of line pressure. In the other type, facing page, left, piston floats on pressure drop, and differential of about 5 psi is necessary to maintain fully open position when energized. In this valve the pilot port is not in the piston, but in the bypass line opened by a midget solenoid. A 10-watt solenoid is sufficient to control this valve in sizes from 1¼ to 2½ in. at pressures from 150 psi in the 1¼-in. size to 90 psi in the 2½-in. size. With a high-



PISTON VALVE employs solenoid-operated bleed; can be normally open or closed type



PACKED VALVE isolates piston, solenoid from corrosive or high-temperature fluids



DIAPHRAGM VALVE handles semi-solids. Resilient diaphragm assures tight closure

power silicone-insulated coil, pressures of 250 to 150 psi can be handled in the same size range. Valves with 3-in. bodies can also be supplied in this same construction. External line modifies valve for normally open use.

Normally-open valves replace 2-way midget pilot with 3-way midget, broken lines. Body cap drillings are shown in drawing of the normally closed valve. With solenoid coil de-energized, pressure on top of the piston is exhausted via an outlet bypass to the downstream side of the valve, causing piston to rise. When solenoid coil is energized, the pilot port closes and main piston returns, closing the port.

This valve and the two integral pilot valves are used to handle clean, low-temperature noncorrosive fluids and are installed where pneumatic or hydraulic pressure is not available for valve operation.

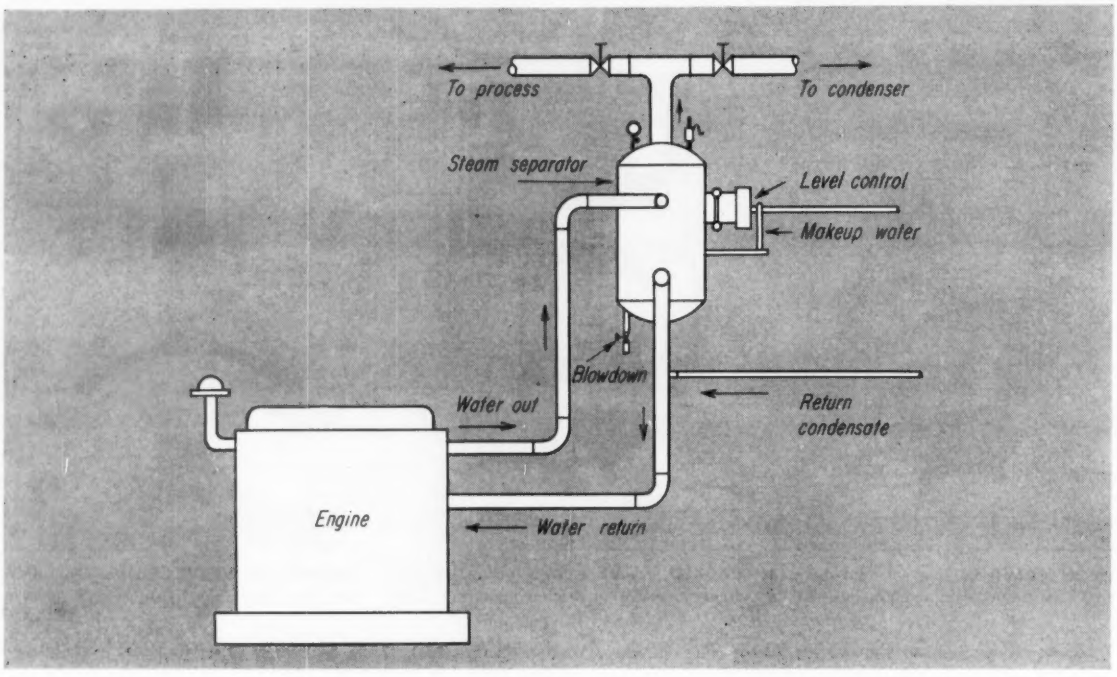
Packed valve, shown above, may be used where an auxiliary source of pressure is available. Such valves are suitable for handling corrosive materials and steam, and are available with bronze, cast iron, cast steel, stainless steel or monel bodies, in ½ to 2-in. sizes.

Operating mechanism consists of two specially designed castings: the upper one containing driving cylinder and bracket for mounting the 3-way midget pilot valve, the lower acting as a base for the cylinder and mounting flange for main valve body. Valve shown has a single-acting spring-return cylinder, but can be supplied with a double-acting cylinder and 4-way midget pilot valve. In that arrangement, flow may be in either direction in main valve. In both cases, valve may be mounted in any position and may be normally closed or normally open, depending on pressure connections to the solenoid pilot.

Although this valve is of packed construction, it does not have quite the disadvantage of ordinary packed valves, namely, possibility of failure from excessive tightening of the packing gland. The extra power in the cylinder and return spring will, to a limited extent, overcome this weakness in packed valves. Most satisfactory operation of any packed valve depends on avoiding drying out of the packing. This is best accomplished by slight leakage of oil, water or steam and there is always a strong temptation to tighten packing which shows such leakage. In most solenoid valves, such tightening will result in failure of the valve to operate properly.

Control of semi-solids calls for a different type of valve. Valves discussed to this point are designed for handling gases and liquids. Close-fitting parts and small apertures in these valves would be sources of trouble if handling slurries, other semi-solids and certain chemicals. These materials are best handled by the diaphragm valve, above. This type of valve requires a separate source of pressure, usually compressed air or clean water under pressure. A midget 3-way pilot valve controls the resilient diaphragm which, when forced downward, closes the port and provides tight shutoff even if small particles lodge on top of the shoulder in the middle of the body. In the small sizes, the diaphragm will snap into the open position without pressure in the main body, but in sizes of 2 in. or larger, the pressure must be sufficient to force the diaphragm fully open.

These valves are available with cast iron, bronze, stainless steel, sanitary or saran-plastic bodies; or the bodies may be lined with glass or rubber for handling chemicals. They may be mounted in any position and are either normally closed or normally open, depending upon where the pressure is connected to the midget pilot and bonnet. Diaphragms are hycar; bodies may be either flanged or screwed. Pressures are limited to 100 psi, temperatures to 180 F. Auxiliary pressures must always exceed the line pressure, but where this is not practicable, an air or hydraulic cylinder may be interposed between the 3-way pilot valve and the main-valve operator.



High-temperature cooling pays off in waste-heat recovery and can . . .

Step up your i-c engine performance

By R C BELLAS, Associate Editor

Power-plant management and engineers, concerned with holding the line against steadily increasing operating costs, are always eager to explore avenues leading to higher efficiencies in equipment performance. In this vein, plant people operating gas- and oil-burning engines might do well to take a hard look at savings possible with high-temperature cooling systems.

For many years much thought and effort has been bent toward securing as much engine waste-heat recovery as possible. The water jacket represented the greatest potential, but with a conventional cooling-temperature range of 100 to 160 F heat-recovery equipment tended to be elaborate and costly. Too, heat recovered could be used only for space and domestic water heating because of its low temperature. As a result, waste-heat recovery has been largely confined to the areas of special exhaust manifolds and exhaust-gas boilers.

What is h-t cooling? Simply a matter of raising the pressure on the jacket-water system. This raises water's boiling point above 212 F. And since only a minor pressure increase is involved (about 5 lb above atmospheric) temperature increase is only about 15 F—not enough to significantly affect pistons or liners or create any new mechanical problems.

Years ago when it was first suggested that internal-combustion engines be cooled with water at 212 F and over, engineers immediately realized that the method would permit utilization of all recoverable engine heat at commercially usable temperatures regardless of power or heat load fluctuations. Originally developed by a West Coast manufacturer under the trade name *Vapor Phase*, present-day systems operate with jacket-water temperatures up to about 250 F.

The schematic drawing, above, shows how a typical h-t cooling system might be used with any new or existing engine. While primarily a cooling system, it lends itself easily to combination cooling and waste-heat recovery applications. A mixture of steam and water passes from the engine to a separator where steam is extracted and water returned to engine at substantially the same temperature as the mixture leaving the engine. Extracted steam goes to process or to a condenser, in either case giving up the latent heat of vaporization for use as desired. Condensate returning to engine cooling system also is at substantially same tempera-

ture as mixture entering condenser.

With water at boiling temperature a high heat transfer takes place even with low coolant velocities. Fig. 1 (from McAdams' *Heat Transmission*, McGraw-Hill Book Co) shows heat-transfer rate between a heated metal surface and boiling water at various temperature differences. It also shows the important fact that heat-transfer rate under boiling conditions depends almost entirely on temperature difference between hot metal surface and water's boiling point—the latter, of course, depending on pressure at which water passes the particular location in cylinder or head, see Fig. 2.

Much more heat is extracted from the metal surface when water vaporizes than would otherwise be possible, and an extremely high heat-transfer rate is available with relatively little temperature difference between water and metal surface. Small vapor bubbles formed leave metal surface, mix with surrounding water and condense—unless all the water is at boiling point, as in a pan of water boiling on a stove.

Advantages of h-t cooling are manifold: It improves engine's mechanical efficiency and, through waste heat recovery, can up the overall thermal efficiency of a plant.

In the U.S., h-t cooling was first studied as a possibility for getting rid of lubricating-oil difficulties in engines burning "sour gas." Like most natural gas this has a rather high percentage of hydrogen which burns to form water vapor. It isn't necessary for gas temperature to drop to dewpoint to cause condensation—this will happen whenever the gas contacts a metal surface having a lower-than-dewpoint temperature. Water alone or sulfur acids act as emulsifier and the stable emulsion formed by intimate mixing with oil gets into the crankcase where it's difficult to remove. This "sludge" forms very rapidly in engines burning sour gas because of high sulfur-dioxide content of the gas. With h-t cooling, cylinder's lower parts are held at higher temperatures than with conventional methods, reducing the possibility of condensation. Sludge formation is cut down, lube life increased. And engines with h-t cooling systems show a marked increase in mechanical efficiency indicating a reduction in "oil drag" in the cylinders.

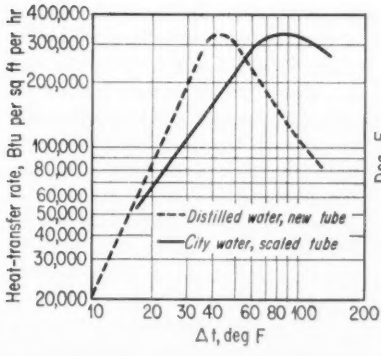
Another favorable factor is that h-t cooling at atmospheric or low gage pressure doesn't materially raise jacket temperature in the engine's upper or "hot" zones. In lower part of cylinder, though, temperature of coolant entering is raised. This tends to produce uniform temperature throughout jackets and engine benefits from straighter cylinders and improved piston clearance.

Most modern engines have water passages and pumps designed to circulate enough coolant to give a low temperature differential across the engine. Differential is usually even less when high-temperature cooling is applied since the circulating water is not intentionally cooled.

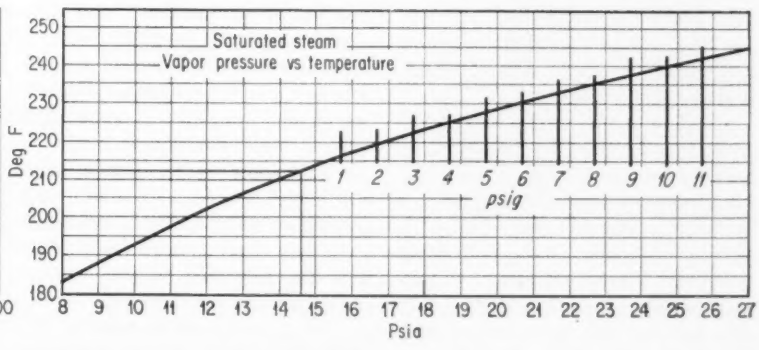
Circulating rates do not materially affect temperature difference when high-temperature cooling is used. Engine manufacturer's flow rates are always satisfactory for cooling at temperatures exceeding 212 F.

Considering gain in overall plant thermal efficiency, it's important to remember that all heat rejected to cooling water is recoverable in its most useful form—low-pressure steam—and all of it can be used without lowering circulating water's temperature below its boiling point at atmospheric pressure. But before waste heat can be used, steam must form in the separator at pressure high enough to deliver it to and through the heating process. Pressure needed determines required temperature and pressure in engine's water jackets. Best bet is to select piping size to hold pressure buildup to 10-15 psig, a safe operating pressure for the modern engine and an ideal range to provide heat necessary for numerous applications normally requiring a heating boiler. One of the most attractive possibilities of high-temperature cooling today is its ability to supply almost cost-free steam to absorption type air-conditioning systems.

Natural-gas burning engines were the original target, but h-t cooling is seeing more and more use with other spark-ignition and diesel engines. It's suitable for residual-fuel-burning diesels, providing a high, even engine heat which should result in much lower maintenance cost through reduced wear on engine parts. It also tends to up overall engine performance, some users state: because of their high heat, engines are capable of efficiently burning more viscous fuels and can idle and run at all speeds on both heavy and light fuels.

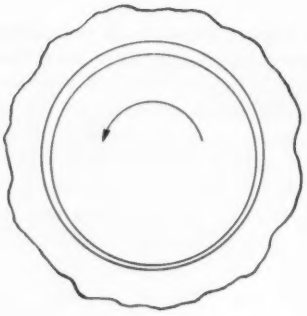


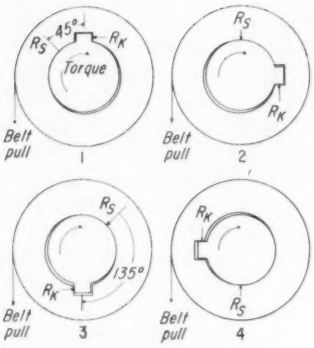
1 At boiling point, high heat transfer will occur even at low fluid velocity



2 Heat-transfer rate under boiling conditions depends on the temperature of the hot surface and water's boiling point. Latter depends on the pressure at any given point

This is what fretting plus corrosion is and what it does





SHAFT SPINNING inside a hub means wear. Wear also occurs between hub and shaft keyed under load pressure. These parts . . . rub every revolution, above. Motion . . .

Here's how to fight fretting corrosion

When wear, corrosion and pressure gang up on machine parts all at once, they create a maintenance problem that's tough to fight. Labeled *fretting corrosion,* this brew of troubles freezes gears and sprockets to their shafts, keeps variable-speed sheaves from sliding and pits bearing raceways. The problem isn't new but is becoming widespread. How do you fight it?—clamps, solid lubes, splines.

Fretting, part one of the label, is wear; not the obvious wear of pistons and bearings, but the wear produced by minute motion of parts under pressure—wear of a few thousandths of an inch or less. Pressure on the parts is the result of load plus weight or just weight alone.

In a sense fretting is simply wobble on a small scale. A sheave and shaft keyed together rotate together. Yet if sheave isn't solidly clamped it will wobble on shaft even if keyed. Wobble isn't visible, but it's there.

Corrosion, the second half of the label, follows right on the heels of fretting. Once small bits of metal are torn from the surfaces they quickly corrode. Eventually rusty specks fill clearance between parts, yet fretting continues. It keeps working until rust packs clearances so tight that all motion between hub and shaft ceases. This stops the fretting but only because the parts are frozen together.

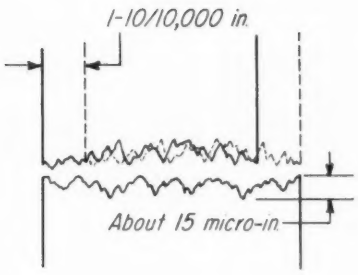
Fretting-freezing cycle takes about a week for most sheaves. You can see fretting results 48 hours after mating sheave and shaft; by week's end freezing has set in. To get the sheave off now takes wheel pullers and brawn. Once it's off both shaft and sheave show a thin layer of rust. Mechanics emery this layer down to base metal before reassembly, but this makes the problem worse. Now the clearance is larger and after reassembly fretting starts again, faster.

Solutions to fretting corrosion aim at stopping the fretting. One answer is clamps. Split hubs and tapered bushings clamp sheaves and sprockets to shafts as snug as a shrink fit and with a clamping force greater than the force causing fretting, see above, so both wobble and fretting stop. Setscrews have the same purpose as clamps but can't hold tight enough to stop the wobble.

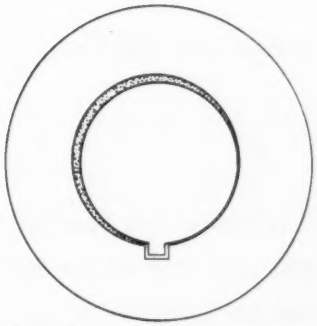
Lubrication is a second answer, although it's just a stopgap. Regardless of lube properties or application method, close attention is needed if you want good results. Regular lubes may help, but not much. Lubes with graphite or molybdenum mixed in are best; they don't prevent fretting but slow the rate and reduce damage enough so you can live with it. Apply the grease-graphite mixture liberally with brush or gun and do it often. It's hard to pinpoint application intervals, but frequencies from once a shift to once every day or so are common. Graphite or moly powders alone, without the grease base, have also been tried but results are not conclusive. For best results bake the shaft after rubbing some solid lube powder on it and do this frequently.

A third approach applies materials that won't fret as shaft and hub coatings. Teflon and rubber are common examples of these coatings; both stop fretting completely, but Teflon is easier to apply than rubber. Spray a Teflon film on the shaft, then bake. Once the film is ready coat with an ordinary grease and assemble the parts. Check results to see that film is right thickness and evenly applied.

Vibration dampers work on the real cause of fretting by keeping parts from bouncing around so much. It doesn't matter whether parts wobble as they work or while they're idle, the result is still fretting (bearings in a machine often pit slightly just during shipment because of truck or railcar vibration.) Dampers help protect idle units that are near busy machines. Whether machine is idle a few hours or several days fretting still occurs, but the longer parts are idle the greater the chance for freezing. Dampers also help protect parts in machines that are working by keeping excessive outside vibration from speeding up fretting action already going on in the working machine.

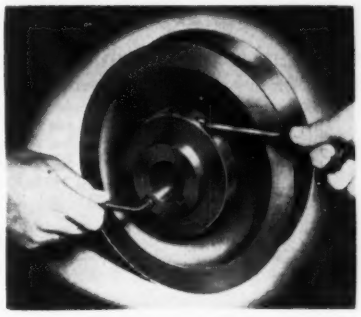


is only a few ten-thousandths, but steady



RESULT: many specks of metal separate from the surfaces, corrode, pack clearance, freeze parts together

These are the tools you can use to fight fretting corrosion



CLAMPING prevents fretting but variable-speed disks must be stopped to alter rpm

in sheaves

By E L NUERNBERGER, Chief Engineer
T B Wood's Sons Company

Variable-speed drives usually present the biggest fretting problem. If single-speed sheaves freeze they may be a nuisance rather than a major headache. But with variable drives there is no doubt about the problem: movable sheaves that stick end variable speed for that drive.

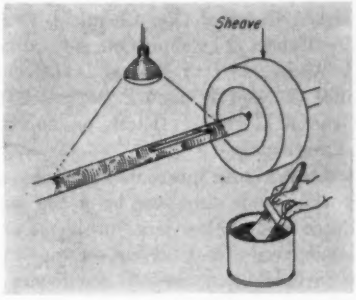
In some smaller units the movable disk is clamped firmly to the shaft. This stops wobble and fretting as it would for single-speed sheaves. It's an effective method, but inconvenient: to change rpm you must stop the drive, unclamp, move the disk, reclamp, start up again.

Some drives have nonferrous sliding surfaces. This stops corrosion but doesn't stop fretting, especially if units are heavily loaded. With light loads and lube, control is possible.

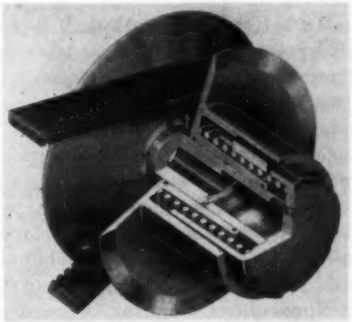
Multiple splines of steel help and of rubber cure. Splines spread the load pressure over many contact points, slowing fretting rate. Although steel splines interfere with good lube distribution, a combination of a solid lube-grease mixture, splines and attention can give good results.

Rubber splines, photo, right, are a final solution. Rubber lets the flange shift in the direction of belt pull at all sheave positions, cutting the tendency to wobble. Each part of the clearance between sleeve and hub opens every revolution so lube gets a chance to do a good protection job.

Although clamping and using nonfretting materials are best solutions to problem, since they stop fretting entirely, they're sometimes impractical. Without them there is still an answer — the right combination of lubes and maintenance schedules.



SOLID LUBE-GREASE mixture is brushed or gunned on often. Powders are baked on



SPLINES spread load, slow fretting. Rubber splines stop metal-to-metal contact

Correction

In the article "Not springs, but *magnets* hold this mechanical seal together" (pp 120-121, December, 1958) this sentence appears: "Seal has been used to 5000 psi at 550 F and at shaft speeds to 20,000 fpm."

Because there is a possibility that this might be construed to mean that all three conditions apply simultaneously, we want to make it clear that this was *not* the meaning intended. The statement might better have been worded "Seal has been used at pressures to 5000 psi, at temperatures to 550 F, and at shaft speeds to 20,000 fpm."

Are breakdowns in your electrical system giving you headaches? Are you growing electrically and looking for ways to avoid future troubles? Then keep your eye on . . .

Electrical maintenance: how experts are tackling it today

How are today's efficient industrial plants going about their electrical maintenance? Six engineers who work with this problem expressed their ideas on important aspects of the subject at a recent session of American Institute of Electrical Engineers. The experts were William A Reece of Dow Chemical, Dean B Kiefer of Bakelite, Robert H Felch of Owens-Corning Fiberglas, William A Weddendorf of Mutual Boiler and Machinery Insurance Co, and William P Burt and Walter A Fleischli of General Electric. (Details on papers appear at the end of this article.)

Organizing preventive maintenance and keeping it working smoothly can be a big problem. But as Bill Reece said: "Most large problems are made up of many smaller ones, and the easiest way to solve the large one is to break it down into small ones and solve them one at a time." Bill ought to know, for problems are almost innumerable in his large, diversified chemical plant. To maintain the plant the electric department employs from 180 to 200 men as linemen, electricians, helpers and supervisors. The huge plant covers 1500 acres, has 600 buildings most of which operate on a continuous basis.

It's necessary to break such a plant into small areas. One journeyman electrician takes care of trouble calls, routine and preventive maintenance in each of 30 routes. Two journeymen from adjacent areas work together on jobs which are too big for one man but not big enough for a construction crew. Two foremen look after the route men and three electrical engineers are available from the office. Most maintenance in the powerhouse proper is done by power department employees. With this setup each man knows his responsibilities and to whom to turn if he meets a problem he can't cope with.

Spare-parts stocking deserves a close look. Standardization of electrical equipment reduces types of parts required. Spare equipment, especially with today's metal-enclosed units, can eliminate stocking of certain parts. New designs may require fewer parts. Example: polyethylene cable can often be spliced without potheads.

Experience tells you what parts are most likely to be needed, and maintenance records also play an important part here. Dean Kiefer says about spare parts, "We carry a minimum of these for 480-volt air circuit breakers because we have several spares in the plant and have always been able to work up some alternative arrangement. . . . We have never needed transformer spare parts and carry only a few bushings and gaskets. In the event of a major failure we would rent a transformer. Oil circuit breakers fall in a different category. . . . We carry a complete set of parts for all standard repairs. Prior to installation of the selective primary system, we carried parts to rebuild an oil circuit breaker. Cable is the . . . most costly item . . . we carry a large supply. . . ."

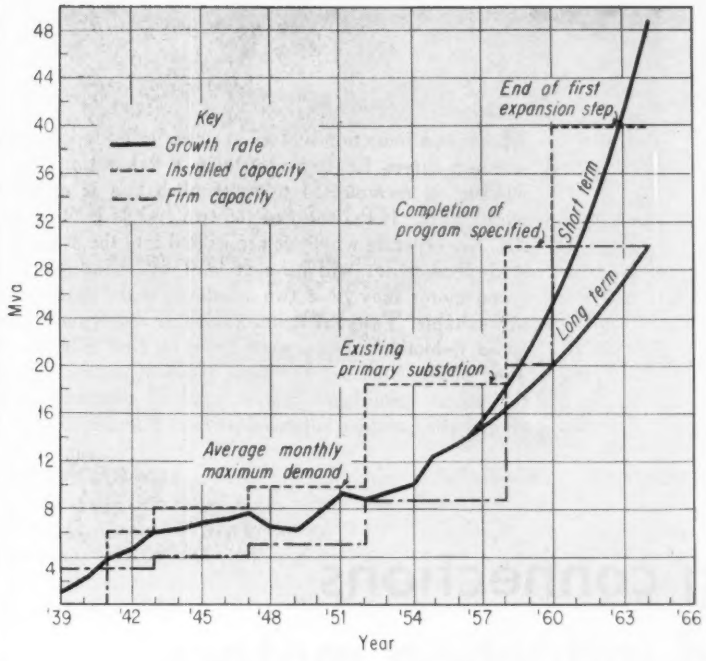
Selling preventive maintenance to management can be the maintenance man's toughest job, although it's usually easy to demonstrate that costly shutdowns can be reduced. But when production booms, it's hard to interrupt it to take care of trouble that hasn't happened yet; when business is slow, preventive maintenance seems like a logical area to economize. So have facts ready to prove its need. Accurate records of how the men spend their time helps.

Training is, in many respects, the key to preventive maintenance. The average industrial electrician "requires training and experience before he becomes proficient in the art of inspection," according to Dean Kiefer. "Somehow, an otherwise excellent man can look straight at trouble indications and still fail to see them."

There is a rigorous training program at the Dow Midland plant. Nearly all electric department men start as helpers and after six months begin formal training. They must be high-school grads with algebra and physics, and are given tests to determine interests, aptitude and IQ. Classes meet about two hours a day, two or three days a week. First course is 72 hours of math review and introduction to Ohm's law. Next, about 24 hours of blueprint reading. This completed (and after at least 12 months in the electric department), the student becomes a senior helper. He then takes 86 hours of dc theory and 22 hours of National Electric Code in a 6-month period. In the final six months he takes 108 hours of ac theory.

The student is expected to spend as much time studying

Preventive maintenance plays key role in plant electrical expansion



Load growth and system expansion to handle it at Owens-Corning Fiberglas plant, Newark, Ohio, followed curves at left. Predicting load growth and providing power to grow *electrically* is only part of plant engineer's look into the future; provision has to be made for preventive maintenance. Equipment should be installed which requires a minimum of maintenance, and it should be made readily accessible for the care it does require. Important in planning is "Reducing to a minimum the affected area in event of a failure of a system component or utilizing device," says Bob Felch, who had maintenance in mind when he presented plans to his management.

With today's stepped-up production efficiency, modern industrial plants afford less opportunity to de-energize work areas for maintenance. Distribution systems which provide selectivity of supply enable some equipment to be temporarily de-energized for inspection and maintenance during regular production.

outside the plant as he does in class. Having completed his courses and two years in the department, he is ready to be a journeyman. Under the training agreement with the unions, a helper must pass each course with at least a grade of 75%, or leave the department. The training agreement applies only to helpers, but two courses are available to journeymen. One covers basic electronics, the other electronic control circuits.

Education doesn't end with a training program. It means keeping men up to date, reminding them of important safety and efficiency principles. In regard to inspection, Mr Weddendorf recommends, "A set of maintenance instructions furnished by the manufacturer or developed for the application should be available to each man servicing the equipment so he will be acquainted with the recommended practices." A program to encourage worker suggestions on work simplification, system improvement, etc can be beneficial.

Scheduling and records can make a big contribution if realistically geared to plant conditions. Paper work can be overdone, but it's the first step in a real engineering approach to maintenance. The Bakelite plant uses checkoff sheets, schedules, record cards and a method of holding shop orders for shutdown periods. Extra inspections can be inserted into the schedule and items inserted or deleted from the checkoff sheets. Inspections are reduced in frequency when repeated inspections don't turn up difficulties; they're increased if repetitive troubles are reported. Importance of the unit is also considered; cost is kept in view. Clerical help is available for the paper work.

Regular inspection is valuable, as Mr Burt of General Electric stressed. Where inspection shutdowns are difficult to arrange, ". . . a program of regular external or surface inspection without service interruption can often detect abnormal operating conditions which may be causing deterioration of the equipment."

The papers referred to in this article are: *Electrical maintenance of a large chemical plant,* W A Reece, assistant superintendent, Dow Chemical Co, Midland, Mich., No. CP59-7; *Preventive maintenance on industrial switchgear, transformers and cables,* D B Kiefer, assistant head of maintenance dept, Bakelite Co Div of Union Carbide Corp, Bound Brook, N. J., No. CP59-19; *Education and maintenance in the operation of industrial power systems,* W A Weddendorf, electrical engineer, Mutual Boiler and Machinery Insurance Co, Waltham, Mass., No. CP59-244; *Designing and presenting to management a power system with maintenance in mind,* R H Felch, electric systems engineer, Owens-Corning Fiberglas Corp, Newark, Ohio, No. CP59-336; *Role of modern switchgear in preventing and coping with operating emergencies,* W P Burt, metal-clad engineering unit, and W A Fleischli, low voltage switchgear dept, both of General Electric Co, Philadelphia, Pa., No. CP58-1344. All papers are obtainable from AIEE, 33 West 39th Street, New York 18, N. Y.

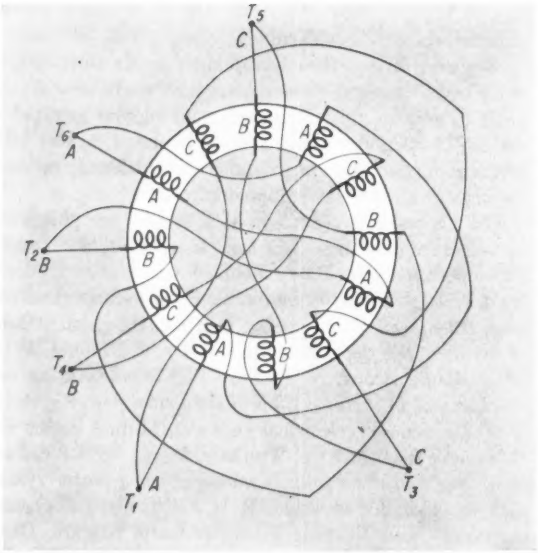
Plant Electrical Fact File

NO. 36: MULTISPEED WINDINGS

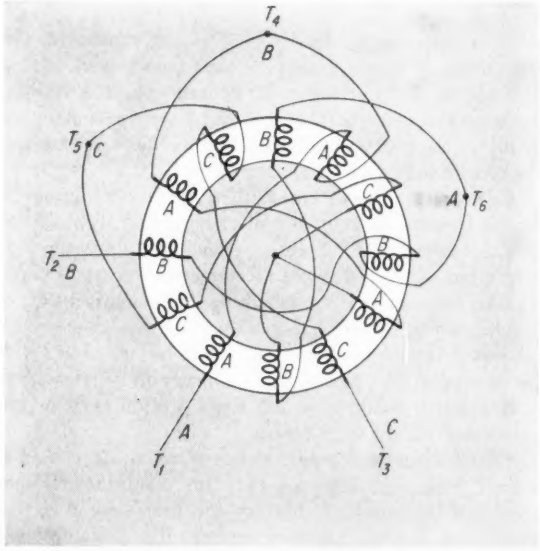
Multispeed induction motors are usually designed so one winding serves for two speeds in a 2:1 ratio. How a winding is reconnected to accomplish this is explained at the right. If the ratio of the two speeds is other than 2:1, two separate windings are wound into the same slots. A 3-speed motor will have at least two windings; a 4-speed motor may have two windings if the speed ratios are suitable. External connections for ten typical multispeed induction motors were given in *Fact File* No. 15, June 1957. Here are the basic types of connections for the stator windings. Stator winding connections for single-speed motors appeared in *Fact File* No. 28.

By NORMAN PEACH, Associate Editor

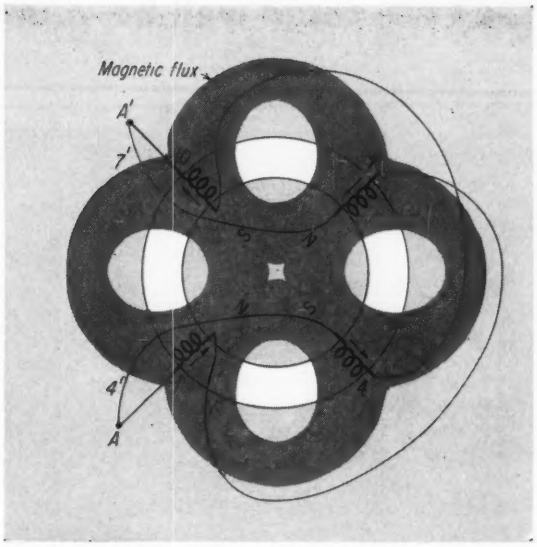
Stator-winding connections for multispeed induction motors



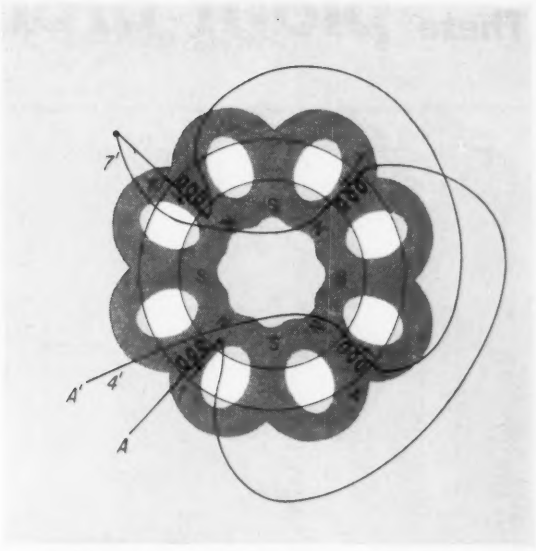
CONSTANT-TORQUE connection is shown for 4-pole stator, but is applicable to other numbers of poles. This connection relates to Sketch 2 of *Fact File* No. 15. Winding is single-circuit delta for low speed (eight consequent poles, 900 rpm) and 2-circuit wye at high speed (four alternate poles, 1800 rpm). *T1, T2, T3* form the wye.



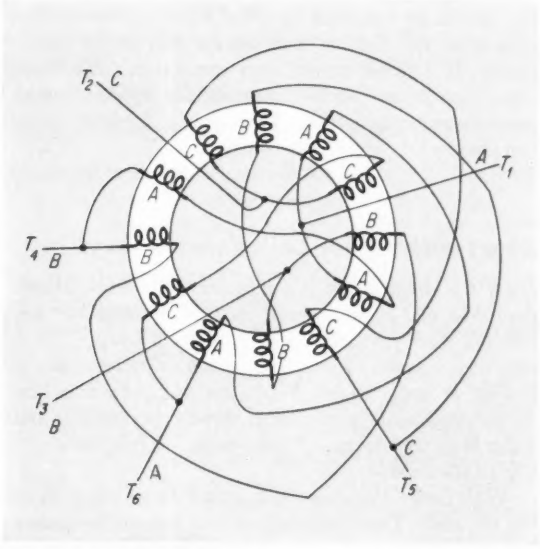
VARIABLE-TORQUE connection, Sketch 3, *Fact File* No. 15, makes use of single-circuit wye for low speed (consequent poles) and 2-circuit wye for high speed (alternate poles). *T1, T2, T3* are connected together to form second wye, and *T4, T5, T6* are used for line leads. Various connections try to match torque and horsepower needs.



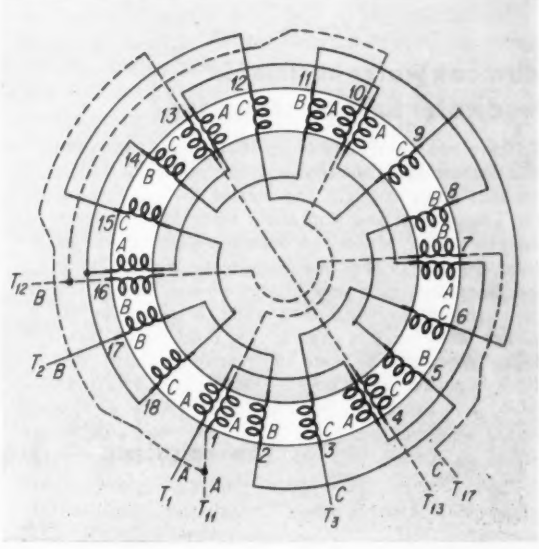
ALTERNATE-POLE connection produces four magnetic poles with four stator coils. Only one phase is shown for this 4-pole 1800-rpm stator. Two *N*-pole coils are in series, as are two *S*-pole coils. The pairs are in parallel, with beginning of Coil *1* connected to ending of Coil *4*, and the ending of *7* connected to the beginning of *10*.



CONSEQUENT-POLE connection produces eight magnetic poles with four stator coils. Connection *1-4'* is opened, and *A* and *A'* are used for the line. Connection *7'-10* is left intact, but disconnected from the line. All coils, now in series, produce *N* magnetic poles. The magnetic flux produces *S* poles in the space between the coils.

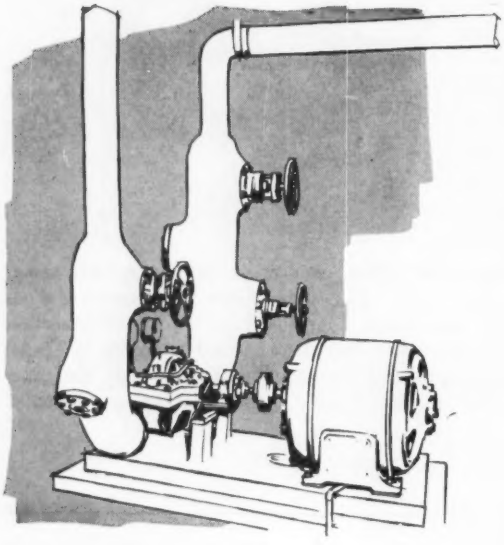


CONSTANT-HORSEPOWER connection, Sketch 1, *Fact File* No. 15, uses the 2-circuit wye for low speed (consequent poles) and the single-circuit delta for high speed (alternate poles). *T4, T5, T6* are the line leads of the delta, with *T1, T2, T3* disconnected. For the low-speed wye, *T1, T2, T3* are the leads; *T4, T5, T6* are the wye.



TWO WINDINGS are used here for two speeds because the ratio isn't 2:1. Low speed is 1200 rpm, has 6-pole short-jumper connection, single-circuit wye. High speed is 3600 rpm, has 2-pole, single-circuit delta. One corner of the delta is opened at *T13-T17* when the low-speed winding is energized to prevent any circulating current.

These **plant problems** could well be yours...



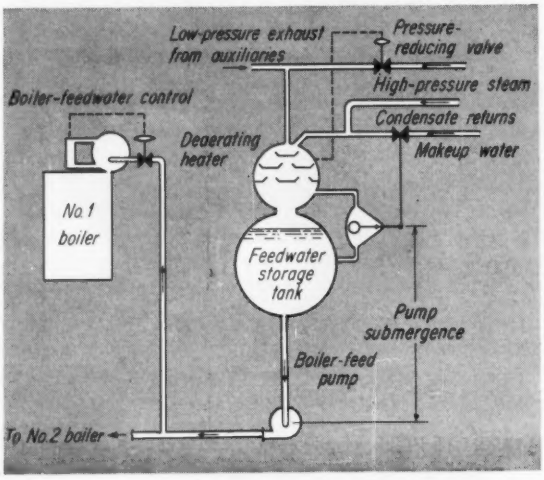
The problem

How can water hammer in feedwater lines be prevented?

We have two centrifugal boiler-feed pumps controlled by a float switch on the feedwater-storage tank. Boilers are shut down at night and started in the morning. The pumps start and stop about every four to eleven minutes. After about two hours' operation we get water hammer in the feedwater lines. We've already had to replace pipe and fittings several times. The hammering stops when cold water is added to the storage tank, but this calls for too much boiler blowdown. What can be done to prevent or absorb this shock on our feedwater lines?—*DAW, February* POWER

Want some help on plant problems? Send us any of your design and operating headaches. We'll put *Power* readers to work on them

The solutions



Make careful check of overall hookup

The information given to diagnose *DAW's* problem is rather meager. Let's start with method of controlling the boiler-feed pump. Boiler-water level must control the feed-pump output. Feedwater storage is normally under the feedwater heater. Level is controlled by a float valve on the makeup-water line. The kind of system shown, above, will not produce water hammer if basic design and operating principles are closely followed.

Net positive suction head (npsh) must meet requirements of pump manufacturer. Available heater steam supply should be sufficient to avoid sudden pressure drops. Otherwise the flashing that results may steam-bind the pump. If exhaust steam from auxiliaries isn't enough, additional steam can be automatically added through a pressure-reducing valve. Pressure in feedwater heater can then be kept essentially constant.

W ROHRHURST, *Bound Brook, N. J.*

Start with higher boiler water level

DAW's problem is too low a boiler water level. Hammer described can happen when feedwater enters the boiler through a conventional *Hartford Return Loop.* This consists of a *balance* line connecting top or steam space with bottom or water space. Feedwater line joins this line at an elevation corresponding to lowest permissible boiler water level and forms a return loop. Here's my explanation of the trouble.

When boiler runs for the first two hours steam is leaving the boiler faster than condensate returns to feedwater storage. Boiler water level drops to low point where feedwater enters the balance line. This brings incoming feedwater into direct contact with steam in the balance line with resultant hammering and damage to the lines.

Naturally, adding cold water to storage keeps float

...Here's how *Power* readers would tackle them

BOB MARKS, Associate Editor

switch at the *on* position longer. The boiler-feed pumps are then able to restore the boiler water level to normal.

DAW should start with a high boiler water level each morning. System may then be able to balance out before steam directly meets incoming feedwater.

E D Dow Jr, *Barberton, Ohio*

Sounds like cavitation is your problem

From the way this question is asked, I assume we are not talking about a boiler-feed pump, but rather a miscellaneous drain pump. It is controlled by suction level in storage rather than by discharge demand as would be the case for a true boiler-feed pump.

The noise is probably cavitation, not water hammer —they can sound very much alike. Operating conditions are satisfactory early in the pumping cycle, so temperature and pressure of water in storage tank is probably less than saturation. But as drain temperature increases, saturation conditions are probably reached. Available npsh is then at a minimum and actually equals static submergence of pump less head losses in piping system between pump and tank. If npsh is too low, severe cavitation is the result.

Adding cold water is a temporary solution since it reduces vapor pressure in drain tank and probably increases npsh available to a point beyond that needed by the drain pump.

Make a very careful analysis of both npsh available and that required by the drain pump to determine adequacy of system. It may be necessary to raise drain tank. In any case suction line losses must be kept down.

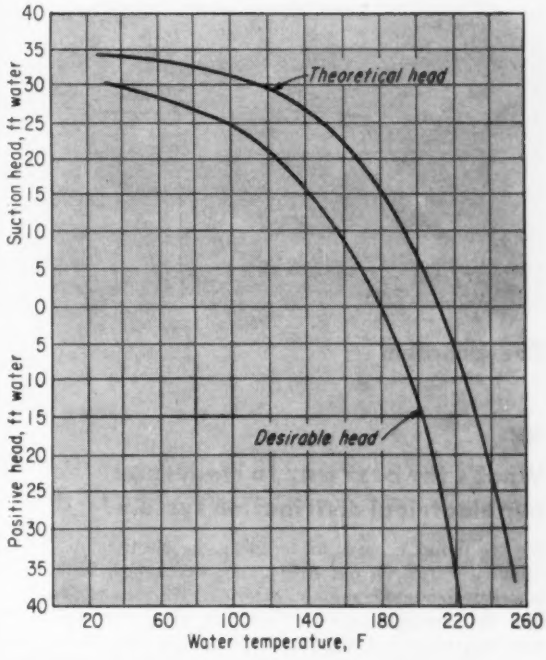
T W Edwards, *Harrison, N. J.*

Here's a thorough 9-point check list

This boiler system has probably never operated satisfactorily. So an exploratory investigation is needed.

(1) Observe water-level gage on boiler from startup to full load. Does it jump around? (2) Check operation of feedwater regulator since stated method doesn't appear to be correct. (3) Inspect feedwater storage tank and see if it's vented. Does excessive steam come out of the vent? (4) Install temperature recorder in storage tank to pinpoint nature of temperature rise. (5) Check all traps for proper operation. (6) Check all equipment for a possible open bypass on the steam traps. If there is more steam than necessary coming into the storage tank, items (5) and (6) may lower feedwater temperature enough to solve problem of steam flashing in the pump. (7) Check piping from feedwater storage to pump. Is size and slope correct? Is the tank high enough? (8) Does the pump packing gland leak air? Is the water seal on the lantern ring working properly? (9) Check discharge piping from the pump to the boiler for size; check valves, etc.

K N Banthin, *Broadview, Ill.*



Measure suction head and temperature

In this case water hammer is caused by pump cavitation. Temperature of feedwater in storage tank is too high. The feed pumps must have enough npsh for troublefree operation. If suction head is too low, cavitation will take place. Curves, above, show theoretical as well as desirable suction head for centrifugal pumps handling water over a wide range of temperatures. Compare your actual suction head with these values. It will probably be necessary to raise the storage tank.

Yee Lee, *Keelung, Formosa, China*

Consider use of turbine type feed pumps

Controlling boiler-feed pumps with a float switch on feedwater storage does not ring a bell with me. Is this level controlled by a water-level controller on the boiler?

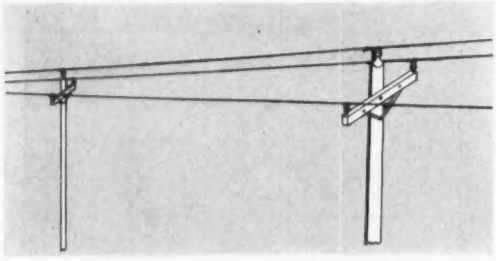
Assuming that *DAW's* control is satisfactory, his feed-pump problem is certainly one of cavitation or vapor binding. In all probability his pump as well as pipe and fittings have been damaged. Increasing npsh is the obvious solution. Also increase the size of your pump suction line and check for items like clogged strainers.

If it's impossible to raise the storage tank, consider use of turbine type boiler-feed pumps. They have much smaller npsh requirements than centrifugal designs. Another possibility is to consider the use of new centrifugal pumps with smaller npsh needs.

G K Pflederer, *Anderson, Ind.*

Turn page for new problems ▶

More **plant problems**



The problem

What's the best way to modernize our electrical distribution system?

We are thinking about modernizing the electrical-distribution system for our strip-mining operations. Load is strictly power for mine dewatering. We plan to install the grounded-phase delta circuit using new outdoor transformers designed for direct feed through to the service wires. Direction is reversed by feeding through opposite end of the transformer. These models have a transformer ratio twice the multiplying ratio when used as a 3-wire transformer.

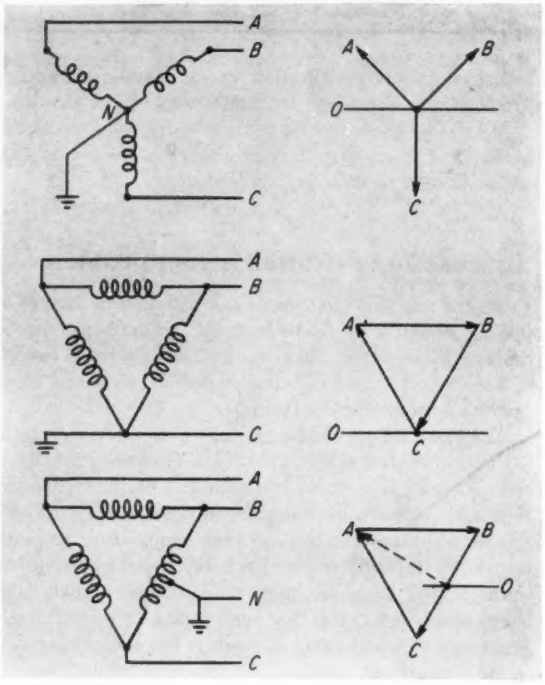
The top conductor will run as phase "C" in the pole line construction and be phase grounded to the primary neutral and grounding connections at the transformer bank. So all the center taps on the transformer must be isolated from ground by removing the transformer straps.

We don't anticipate trouble with the new load wiring, but the insulation is a question mark on the old installation. So caution must be exercised before converting to grounded-phase power. Perhaps some reader with recent experience can tell us how to conduct a megger program with minimum downtime.

Since the center-tap grounding of one transformer in existing service will be eliminated, we plan to identify the grounded phase either by its position in aerial construction or by colored insulation We'll use it as the interconnecting grounding conductor for primary and secondary grounds without running a fourth wire. In the case of equipment grounds we'll run a fourth wire between motor frame and switchgear on the supply side to prevent loss of ground when the starter is open.

Improved fuse coordination is anticipated because of the grounded service with maximum voltage (phase to phase) from ground to hot wires. We would like to have comments and suggestions on our projected conversion plans.—*WA, February* POWER

The solutions



Modern electrical systems ground neutral

The changeover which *WA* plans for his strip-mining electrical distribution system presents some interesting problems, but with several important facts (such as the voltages involved) not available, it's possible to give only hypothetical answers. The grounded-phase delta distribution system apparently appeals to *WA* because it is the simplest method for providing a system ground on a 3-phase system. I take it that most of his distribution will be by pole line, and it certainly is simple to provide equipment grounds where necessary in the manner he describes.

Corner-of-delta grounding, however, has several disadvantages which have resulted in its being seldom used today. I'm sure that more than one electrical engineer would object to calling conversion to this system "modernization." The best guide I know to good grounding practice is the booklet published by the American Institute of Electrical Engineers called *Grounding of Industrial Power Systems* (AIEE No. 953, Oct 1956). *WA* can obtain a copy by writing to AIEE, 33 West 39th Street, New York 18, N. Y.

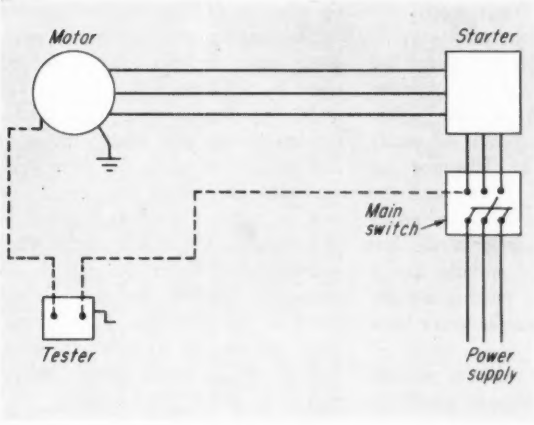
Three grounded systems are compared in the sketch above. The grounded secondary neutral is the most common. It has advantages of dual-voltage service and low voltage to ground. I think *WA* will be wise to reconsider the grounded-neutral system even though it will involve running an extra conductor. The grounded-phase (corner-of-delta) system which he proposes has these disadvantages: (1) inability to supply dual-voltage service for lighting and power load (2) requires positive identifica-

tion of the grounded phase throughout the system to prevent connection of meters, instruments, protective relays, etc in the grounded phase (3) line-to-ground voltage is higher than in system with grounded neutral. This last is basis for *WA's* concern in regard to older part of his system.

One advantage claimed for grounded-phase system is possibility of better performance of 2-element motor starters under unusual fault conditions. With the two elements connected in the ungrounded phases, and a properly connected control circuit, a ground in the control circuit will not start the motor nor prevent its being stopped by pressing the stop button. Since this contingency is rare, the advantage is usually outweighed by the disadvantages.

A third system sometimes used where single-phase transformers are connected into a 3-phase bank is to ground a center tap on one of the single-phase transformers. This gives some of the advantages of a grounded-neutral system, particularly dual-voltage lighting service. But this produces an unbalanced load. Also, it's not employed very often today because tapped transformers aren't generally available. Everything considered, I say the neutral is the place to ground!

EMIL WAGNER, *Minneapolis, Minn.*



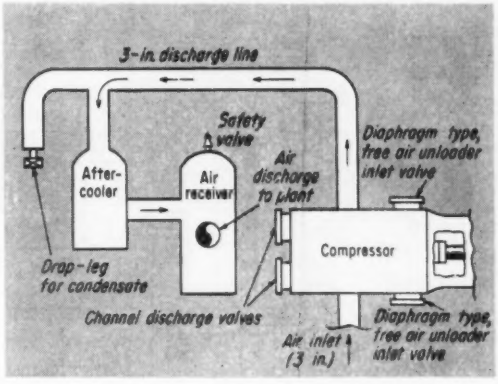
Make insulation resistance tests quickly

Insulation testers are available that permit testing with minimum effort and time. Connecting one test lead to the tested machine and the other to ground allows test to be made with little downtime. Sketch, above, is hookup for testing motor insulation. Similar arrangements are used for generators, transformers and other equipment. Switches which easily permit isolation of parts of system are a big help.

Readings for the same equipment may vary from day to day. Don't consider this variation to mean that insulation failure is imminent. Ambient condition, equipment temperature and moisture influence the readings.

H B WAYNE, *Woodhaven, N. Y.*

Your May problems



How can we avoid sticky discharge valves on our air compressor?

I'm steam-plant superintendent for a large paper company. Rough sketch, above, details our single-stage air-compressor system including aftercooler, air receiver and plant discharge. Compressor operates 24 hours a day, 5½ days a week. We use what is considered the best compressor oil available. Water temperature to the cooling jacket is maintained in the range of 100 to 110 F.

We are having a tough job keeping the top end-discharge valve free from carbon, sticking, etc. All valves are cleaned once a month, and each time this one valve is found in bad condition. What are some of the ways that we can solve this problem?—*WDD*

What disposal methods are best for fluid radioactive waste?

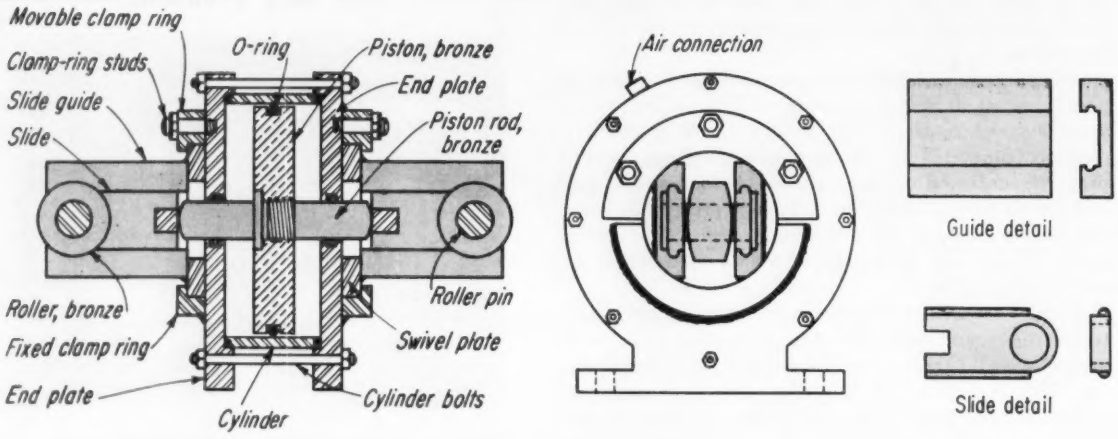
Our chemical-manufacturing plant is investigating a new process involving use of a radioactive material. My part of this project includes plans for handling the process wastes. And in this case the waste problem is almost too hot to handle.

Process effluent is a strongly acid fluid with a pH of 2.0. It contains both dissolved and suspended radioactive substances. To make the process pay we must be able to come up with a practical method for disposing of radioactive material with a 10-year half life.

The plant site is on a river, several miles away from a large body of salt water. I would appreciate any suggestions POWER readers may have concerning possible waste-disposal schemes. We plan to evaluate those methods that look promising on a pilot-plant basis.—*SEL*

Sit down right now and answer one or both problems. We'll pay extra for answers with photos or sketches

Timely **practical ideas** to help solve



This air jack for turbine spindle is a little giant, moves a 36-ton rotor

On turbine overhauls, we always check the amount of spindle thrust or "float" by moving the spindle back and forth between the limits of the thrust bearing. We also block the spindle in its full-forward position when taking wheel, diaphragm and packing clearances.

In the past, we placed a wooden wedge behind the last-stage wheel for moving the spindle ahead. Also, one wedge was put ahead of the first-stage wheel for moving the spindle aft. While taking wheel clearances, the spindle was blocked ahead by the wedge behind the last-stage wheel.

A lot of time and energy was used in pulling and reinserting the wedges while floating the spindle. Reason: The wedges were driven with a lead hammer. When the spindle bearings were a bit dry, the wedges were driven in tight. Also, the spindle had to be rotated while checking the float, and to various positions while checking wheel clearances. If the wedge was tight, quite a bit of pull was required by the crane to overcome wedge friction.

Then came the dawn. Why not use an air cylinder, mounted between the inner wheels on the double-flow end of the low-pressure turbine, with rollers on the ends of the piston rod to contact the wheels while the spindle was being rotated.

Since the cylinder was to be double acting, we'd eliminate the effort and friction caused by the wedge. By turning a valve, the spindle could be moved back and forth and also blocked forward when necessary.

We found the distance between the wheels and engineered the cylinder to fit this space. The phrase "dynamite comes in small packages" really applies to this jack. Distance between the wheels is 13-in., and the cylinder, complete with self-aligning rollers is only 12⅝-in. overall, but it moves 36 tons of spindle like a feather. We are now putting a regulator on the cylinder so it won't bend the wheels.

We designed the cylinder around a piece of 6-in. schedule-80 pipe. To make the equipment more compact, we used O-rings for sealing. All internal machining was done to standard O-ring tolerances. Piston, piston rod and rollers are made of bronze; the rest of the cylinder, excepting the pipe, is made of boiler plate. End plates are secured by eight SAE-4140 steel bolts. O-rings are used for sealing the piston, end plates and around the piston rod where it comes through the end plates.

Roller assembly is unique. Instead of fastening the rollers to the piston rod, each one is secured between two slides. Slides have a key fitting between them, and a piston rod contacts this key. As the slides are independent of each other, the roller can allow for (1) any unevenness on the wheel and (2) slight misalignment.

Slide guides are welded to a swivel plate which is held against the end plate by a clamp ring. Clamp ring is in two pieces—the lower half is welded to the end plate; the upper half is held in place by three studs. By using this setup, the swivel plate can be rotated until the roller pin is parallel to the radius of the wheel, assuring full roller contact. Clamp rings are tightened and the assembly stays in this position. This arrangement allows the cylinder to be set well above the wheel center line and still have good roller contact.

We fastened the cylinder assembly to a piece of boiler plate bolted to the inner double-flow diaphragms. Center line of the cylinder is about 5 in. above the wheel center line. Slides, slide guides, swivel plate and clamp ring are built heavy to prevent any bending action when the roller is in contact with the wheel.

Air ports are drilled into each end plate. A standard 4-way valve is connected to a piece of tubing connecting the ports. Valve is ported so air is bled out of one end of the cylinder while air is being admitted to the other end of the cylinder. This jack has saved us a lot of work.

H C Bosley, *Long Beach, Calif.*

your tricky design and maintenance problems

STEVE ELONKA, Associate Editor

Stethoscope spots trouble

Operating engineers have been using flashlights and screwdrivers as stethoscopes to trace engine noises for years. Now along comes this nonelectrical instrument — developed by the M Paquet and Co, Inc, New York, N. Y.—to help you do a professional job of diagnosing.

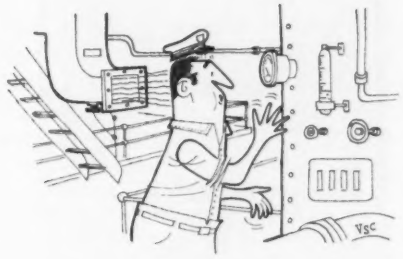
Sound is picked up by probe, then amplified in the chamber inside the handle. Chamber has a screw for changing the frequency within the cavity. It amplifies some sounds, suppresses others. By making the right adjustments, you can eliminate unwanted sounds and clearly pick up those you want.

You can isolate sounds, knocks, rubs, grinding, taps, vibrations and leakages of air or gases in bearings, gears, shafts, valves, pistons, feed lines, etc. On one compressor it found a faulty feather valve, connecting-rod bearing and flow of refrigerant in valves and connecting equipment.

Instrument comes with a plastic probe for checking electrical connections. Small needle mounted on end of the probe can be put on the brushes or brush caps of a motor.

If you don't know . . .

how to time a diesel, starting with scribing the original timing mark on the flywheel, *Plant Operators' Manual*, McGraw-Hill Book Co will show you.

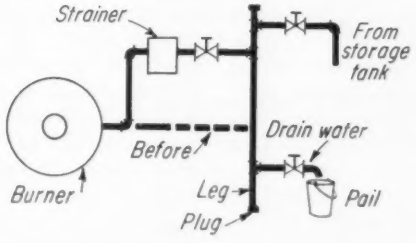


What would you have done?

I was in the Merchant Marine, working aboard a freighter as second assistant engineer. The watertender complained that the boiler-feedwater regulator wasn't working properly and that it was necessary to crack the auxiliary feed check to maintain the proper water level in No. 3 boiler. These boilers were equipped with thermohydraulic type regulators for single-element drum-level control.

When I closed the auxiliary check, the water level dropped to about ½ in. in the gage glass and stayed there. Climbing up to the boiler drum for a quick inspection, I noticed the control valve indicator showed the feed valve was barely open. I was about to check the piping for leaks when I felt a blast of cold air on the back of my neck. Then it dawned on me! Someone had opened the outlet in the ventilation duct, allowing cold air to blow on the radiating fins of the regulator. This accelerated the normal radiation losses and decreased the vapor pressure acting on the feed valve bellows. This accounted for the valve being only partially open. I closed the ventilating duct damper and within a minute the water level in the boiler was normal. What would *you* have done?

P HAHN, *Norristown, Pa.*



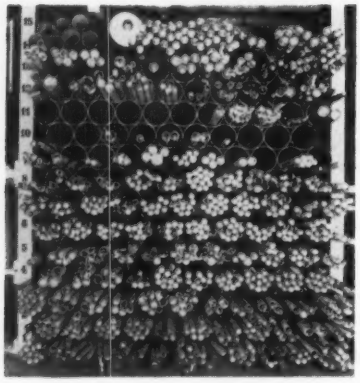
Water leg eliminates startup troubles

We had a problem from water settling in our fuel-oil line to the burner. This was especially troublesome after a week-end shutdown. When opening the valve, a shot of water kept the fire from starting.

To solve our problem I raised the line to the burner, sketch. I also installed a leg on the tee to act as a trap. A valve near the bottom of the leg is now used to drain the water before starting the unit.

Before starting the boiler on Monday morning, I open the drain valve on the tee leg and drain the water until oil shows up. This has eliminated our startup troubles.

E CHAPMAN, *Toronto, Ont.*



Fiber tubes protect aluminum extrusions

Storing long extrusion tubes can be a big headache. Photo shows a simple way to do the job.

Each tube is identified by a letter and a number, showing its position in the rack. And a corresponding chart shows the contents of each fiber tube.

Fiber tubes are fire resistant, easy to stack as shown. They keep material clean and provide an easy-to-build low-cost storage rack.

J E LANE, *New York, N. Y.*

Don't let this happen to you!

An ice company added a freezer-locker plant. Diesel engines drove the two compressors and a couple of 220-volt ac electric generators that furnished all the power and lighting. Because of the assortment of equipment used in the overall development —diesel engines, electric generators and motors, ammonia compressors for ice-making and ammonia compressors for the low temperatures needed for locker freezing and storage operations—lube oils were selected on the basis of lubricating needs of each type of equipment.

One grade of oil was selected for the diesel engines, another for the ammonia compressors and, finally, another grade for compressors handling low-temperature work. These oils were stored in the engine room.

In spite of the importance of using the correct oil, there was no marking on containers to identify contents.

Trouble started in plant's freezing room when temperature couldn't be held closer than 10 F to that needed.

A quick check showed that the low-temperature compressors were being lubricated with diesel-engine oil having a pour test of +20 F. Since the temperature of the evaporating ammonia in the freezer-room coils was –17 F, the diesel oil carried over from the compressor crankcase was not removed entirely by the high-pressure oil separator on the compressor discharge line. Some oil got into the liquid receiver, passed with the liquid ammonia to the cooling coils of the freezer room, where it congealed and remained.

No provision had been made for drawing oil from these coils through properly located drains. So oil remained in the coils until the plant shut down for the purging operation at which time drain valves were installed for future protection. Of course, the correct oil was used as soon as possible, but the damage had already been done.

Careless choice of a lubricant has been the cause of similar troubles in many other plants I've visited. Ignorance, laziness and indifference are usually responsible for such mistakes.

C T BAKER, *Atlanta, Ga.*

My biggest boner

Several years back, when fuel oil was gushing out of the ground in Texas, we changed from burning mesquite wood and coal to fuel oil. This oil fresh from the ground contained everything: gasoline, propane, black oil and gas. It was high-powered stuff, not the residue oil we burn today. In our small factory, I was tagged an "expert" fireman, because I had worked in many types of power plants, including marine.

Early one morning I started the oil pump, but couldn't raise oil from the big storage tank. It was a large steel tank set flush with the floor with its bottom end buried 10 feet below. At the end of the suction line was a foot valve. I knew that the tank was almost empty, so I wanted to see if the oil was below the suction line.

Thinking back on what I did causes me to shudder. Why? Because I grabbed the kerosene oil lantern, lit it, then tied a line to the handle. Removing the manhole cover, I lowered the lighted lantern into the tank so I could see the suction line. Because the lantern flickered, then almost went out, I kept swinging it around and around to get a good view. Brother, I was asking for it!

After removing the lantern from the tank I suddenly realized that I could have been—and *should* have been—blown clear up to the moon. I keep wondering why that open light didn't explode that mixture of highly explosive gases.

This is the biggest boner I ever pulled—and it's a dandy. Wish some of you POWER readers would write in to give your theory on why I wasn't put in orbit. And I sincerely hope none of you ever lower a lighted lantern into any kind of fuel-oil tank —unless you are tired of living.

W R PENDER, *St. Petersburg, Fla.*

FOR YOUR ENGINEERING LIBRARY

DATA SHEETS — VOLUME 1 — 46 of the most popular data sheets, taken from the pages of POWER, printed on special stock and bound in plastic. A valuable addition to any library. **Price per copy $1.00.***

FUEL FACTS—Up to date information on the important subject. Contains Fuels — A Look Ahead; Fuels & Firing; Fuel Handling and Storage; Clean Air—the Engineer's Way. A $2.95 value, yours for only $2.00.*

BASIC DATA ON SEALS — Reports on Packing, Piston Rings, Gaskets, Seals, in attractive binding. **Per Set $2.50.**

ELECTRICAL REFERENCE FILE — Reports on Electric Motors, Industrial Lighting. Today's Electrical Practice, Transformers, Measuring Electricity, in colorful plastic binding. Per Set $3.50.

PLANT SERVICE FILE — Heating, Air Conditioning, Refrigeration, Pumps, Fans, Compressed Air, Lubrication. Bound in plastic — colorfully illustrated — more than 104 pages. **Price $4.50.**

BASICS . . . bringing engineering theory down to earth. Reprints of popular article series from POWER. Covers Electricity, How Fuels Burn and Fluid Facts. 42 pages, plastic bound. $1.00 per copy.*

VITAL ENGINEERING DATA — Important utility, Industrial, institutional steam and hydro plants planned, built and operating since 1952. **Price $2.50.**

GET YOURS NOW! USE THIS HANDY COUPON

POWER, Reader Service Department
26th Floor, 330 West 42nd Street
New York 36, New York

5-59

*Discounts available on starred items: 10% on orders of 10 or more.

Please send me _____ copies of each of the reports checked below. I enclose $_____.

Name_____

Address_____

City_____

State_____

1. Data Sheets **5. Plant File**
2. Fuel Facts **6. Basics**
3. Data on Seals **7. Vital Engrg.**
4. Electrical File

☐ Check here if you'd like free folder describing these and 32 other reports.
☐ Check here if you are interested in a subscription to POWER at $5.00 per year.

PROFESSIONAL SERVICES

BEISWENGER, HOCH AND ASSOCIATES
Consulting Engineer
Surveys, Design, Field Supervision
Power and Transmission, Waste Treatment, Chemical, Civil
Akron, Ohio Jacksonville, Fla. Nashville, Tenn.

BLACK & VEATCH
Consulting Engineers
Electricity—Water—Sewage—Industry
Reports, Design, Supervision of Construction, Investigations, Valuation and Rates
1500 Meadow Lane Pkwy, Kansas City 14, Missouri

PETER F. LOFTUS CORPORATION
Design and Consulting Engineers
Electrical • Mechanical • Structural
Civil • Nuclear • Architectural
First National Bank Building
Pittsburgh 22, Pennsylvania

ALDEN S. STILSON & ASSOCIATES
Consulting Engineers
Industrial & Municipal Power Plants
Surveys, Reports, Design & Supervision
Columbus, Ohio Cleveland, Ohio

BURNS & McDONNELL
Engineers — Architects — Consultants
4600 E. 63rd St. Trafficway
Kansas City 41, Missouri

CHAS. T. MAIN, INC.
CONSULTING ENGINEERS
Design—Construction Management
Steam, Hydroelectric & Diesel Plants
Gas Turbine Installations
Transmission—Distribution
Boston, Mass. Charlotte, N. C.

SWANSON, WRIGHT & CO. ENGINEERS, LTD.
Consulting Engineers
Forest Product Industries
Thermal Power Plants
Industrial and Process
2210 West 12th Ave. Vancouver 9, B.C. RE 8-1154

GILBERT ASSOCIATES, INC.
Engineers and Consultants
Design and Construction Supervision
Mechanical • Electrical • Nuclear
Sanitary • Chemical Laboratory
Business and Economic Research
New York Reading, Pa. Washington

PIONEER SERVICE & ENGINEERING CO.
Consulting and Design Engineers
Purchasing
Specialists in
Financing, Accounting Other Operations
231 So. La Salle St. Chicago 4

TIPPETT & GEE CONSULTING ENGINEERS
Mechanical—Electrical—Thermodynamic—Structural
Design—Studies—Supervision
Power Stations—Transmission—Distribution
Industrial Plants—Process
1333 North Second Street Abilene, Texas

INTERNATIONAL ENGINEERING COMPANY, INC.
Engineers
Investigations — Reports — Design
Procurement — Field Engineering
Domestic and Foreign
74 New Montgomery St., San Francisco 5, Calif.

SARGENT & LUNDY
Engineers
140 South Dearborn St., Chicago, Illinois

WATER SERVICE LABORATORIES, INC.
Specialists in Water Treatment for Corrosion Prevention
Main Office
615 West 131 Street New York 27, New York
Offices also in Phila., Wash. & Richmond, Va.

THE KULJIAN CORPORATION
Engineers - Constructors - Consultants
POWER PLANT SPECIALISTS
(Steam, Hydro, Diesel)
Utility • Industrial • Chemical
1200 N. Broad St. Philadelphia 21, Pa.

J. E. SIRRINE COMPANY
Engineers Since 1902
Consultations • Design • Reports
Steam & Hydro Power Plants
Steam Utilization
Laboratory Analyses of Water
Greenville, South Carolina

THE J. G. WHITE ENGINEERING CORPORATION
Design-Construction-Reports-Appraisals
80 Broad Street, New York 4

WHERE TO BUY

Featuring additional products, specialties & services for power plants

PAINTING CONTRACTORS
Specialists in
Power Plants, Refineries, Chemical Plants
HARTMAN-WALSH
5078 Easton St. Louis 13, Mo.

This WHERE TO BUY section is a special classification for manufacturers desiring advertising in space units smaller than the minimum run of book display space. Space is available in this section in units from one to four inches. Each advertisement is indexed. For low rates write: Classified Advertising Division.
POWER, 330 West 42nd St., New York 36, N. Y.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: **"OPPORTUNITIES"** :EQUIPMENT :USED OR RESALE

JOBBERS WANTED:
We manufacture Kob-Kleen (ground corn cobs) for soft grit blasting of electric motors and generators for 75% savings in time, material and labor. Many other industrial uses. Nationally advertised. *Write* COEVAL INC., Dept. C., St. Joseph, Illinois.

ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication
Send to office nearest you.
NEW YORK 36: P. O. BOX 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

POSITIONS VACANT

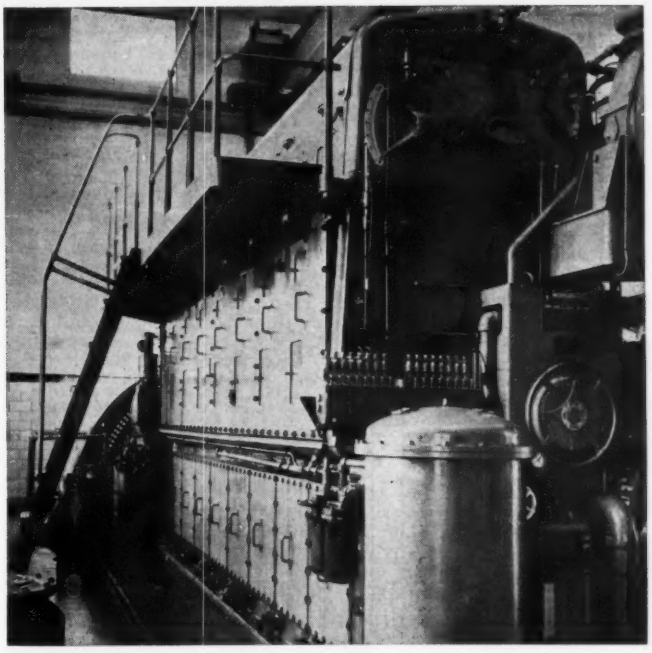
Power Engineer. Assist in supervision of new power boiler, turbo-generator, and chemical recovery unt. Prepare manuals, train operators, and supervise personnel. Expanding high grade paper mill located in the Middle Atlantic States. Minimum three years' experience with high pressure boilers and generators. Engineering Degree. Include resume and salary required. P-9809, Power.

POSITIONS VACANT

Engineers with extensive experience in the operation and maintenance of complex utilities systems are needed by the Air Defense Command at salaries starting at $7510 and $8810 a year. The openings are at electronic air defense installations and Division headquarters in the Southern and North Central parts of the country. The power, heat and air conditioning equipment in Sage installations is large and complex and includes diesel generating equipment operated in parallel, power plant switch gear equipment, high pressure fire tube steam boilers with associated equipment, refrigeration and air conditioning equipment of over 100 ton capacity, and other complicated equipment used in heating, ventilating and controls systems. Engineers employed in a Division headquarters will function n a staff capacity in such fields as Electrical, Mechanical (Heating, Air Conditioning, Diesel), Civil and Civil Planning, and General (Structural, Sanitary, Paving) Engineering. Inquiries about these positions and applications should be directed to the Director of Civilian Personnel, Headquarters Air Defense Command, Ent Air Force Base, Colorado Springs, Colorado.

SPECIAL BARGAIN OPPORTUNITY – IMMEDIATE DELIVERY

MODERN NORDBERG DUAL FUEL SUPERCHARGED ENGINE DIRECT CONNECTED TO A 1775 KVA - 1420 KW AT 80% P.F. 3 PH. 60 CY. A.C. GENERATOR



ENGINE

2000 BHP, 327 RPM Nordberg Mfg. Co. Supairthermal 4 cycle, 8 cylinders, 16" bore by 22" stroke, supercharged dual fuel engine, direct connected to:

GENERATOR

1775 KVA — 1420 KW at 80% P.F., 327 RPM, 3 phase 60 cycle, 426 amperes, 2400 volts Electric Machinery Mfg. Co. alternating current synchronous generator.

EXCITER

20 KW, 125 volts, 160 amperes, 1750 RPM Electric Machinery Mfg. Co. direct current exciter.

Complete installation with full auxiliary equipment, switchboard instruments, radiator cooled.

INSTALLED 1955 — OPERATED ONLY 6000 HOURS
EQUIVALENT TO NEW—ATTRACTIVELY PRICED

UTILITIES MACHINERY CORPORATION

900 NATIONAL CITY EAST SIXTH BUILDING • Telephone: CHerry 1-0210 • CLEVELAND 14, OHIO

POSITIONS VACANT

Continued from opposite page

Wanted . . . Plant Engineer . . . To take direct charge of heating plant, distribution system, electrical and plumbing work in eastern college. Central heating plant with both coal and oil burning equipment. In reply, state education, training, experience, age, current salary. If married, state number of children. Where employed during last five years. P-1464, Power.

POSITION WANTED

Chief Engineer, age 38, technical education, 14 years experience in the operation, maintenance, construction, and plant betterment of turbo-electric power plants. PW-9551, Power.

BUSINESS OPPORTUNITY

Ambitious Assistant Chief Engineer age 37, mechanical graduate, P.E., wishes to invest with full participation in engineering or manufacturing business having growth potential. 14 years of diversified experience in piping, plant and administrative engineering. BO-1392, Power.

When Answering BOX NUMBERS

to expedite the handling of your correspondence and avoid confusion, please do not address a single reply to more than one individual box number. Be sure to address separate replies for each advertisement.

LEFAX
TECHNICAL DATA BOOKS
POCKET SIZE • LOOSE LEAF

12th's ed., 9 Bks., 8½"x11¾" bond paper, each book approx. 140 pages of technical data for student, engineer, technical worker. $1.25 ea.

Architecture	General Math	Phys. & Thermo. Data
Home Heating	Math Tables	Metals
Illumination	Physics	Metallurgy
Electrician's Data	Trig-Log Tables	Hydraulics
Builder's Data	Gen'l Chemistry	Radio
Lumber Data	Chemical Tables	Television & FM
Air Conditioning	Analytic Chem.	Electricity, AC
Building Constr.	Mech'l Drawing	Electricity, DC
Reinf. Concrete	Machine Design	AC Motors & Gen'trs.
Piping Data	Machinist's Data	Transformers, Relays & Meters
Surveying	Mech. of Materials	
Surveying Tables	Pwr. Trans. Mech.	
Highway Eng'g.	Thermo. Tbls.	

Write for FREE catalogs (2000 listings). Send $1.25 for each book or $6 for any five books to
LEFAX PUBLISHERS, Dept. PO-59, Phila. 7, Pa.

WE PAY
$ CASH $
FOR
Electric Motors • Starters • Transformers
Circuit Breakers—Electric Supplies
ALLIED ELECTRIC CO.
710 N. MAIN ST., MEMPHIS, TENN.
BOX 1838—PHONE JA 7-1681

GET CASH NOW
for your new surplus motors, controls and transformers!

AVAILABLE: NEW MOTORS
Over 5,000 new motors in stock from ½HP to 200 HP. Special low prices!
Write, wire or phone collect!
AJAX ELECTRIC MOTOR CORP.
P.O. Box 267 Rochester N.Y.

COMPLETELY PORTABLE
G.M. 150 KW A.C.
DIESEL GENERATOR SETS
SELF - CONTAINED PACKAGE UNITS WITH BUILT-IN SWITCHGEAR AND RADIATOR, MOUNTED ON OIL FIELD SKIDS

ENGINE: GM 110—6 cyl. GENERATOR: Delco 150 KW—187.5 KVA—208/240/416/480 volts 3 phase 60 cycle. 520/452/260/226 amps. Excitation 125 volts DC. Units are completely hooded, on oil eld skids, with tanks in base. With radiator & panel board. Just plug in for any of the above voltages. No piping or heat exchangers to hook up. Ideal for oil field use, marine construction, offshore drilling rigs, dredges, standby generators, etc.

THE BOSTON METALS CO.
313 E. Baltimore St.—Baltimore 2, Md.
ELGIN 5-5050 — LEXINGTON 9-1900

CHECK WITH WAGNER FIRST!

Thousands of new and "Certified Rebuilt" Motors & Generators in stock—up to 1000 H.P. OUR 53rd YEAR

A. C. MOTORS—60 CYCLE

HP	Mfr.	Type	Volts	Speed
800	Whse. (2)	Sq. Cage	2300	1800
700	Whse.	Slipring	2300/4000	1200
600	G.E.	Synch.	450	900
600	Elliott (2)	Sq. Cage	2300	900
500	Whse.	Sq. Cage	2300/440	1200
500	Allis Ch.	Slipring	2300/440	600
400	Whse. (2)	Synch.	2200	1800
400	Whse.	Sq. Cage	2200	514
400	Marathon (2)	Sq. Cage	2200	3600
400	G.E.	Slipring	2300	514
350	Br. Boveri b.b.	Sq. Cage	4800/480	720
350	G.E.	Sq. Cage	2200	1800
350	G.E.	Slipring	440	1200
350	Allis Ch.	Slipring	2200/4000	600
350	G.E.	Slipring	220/440	900
300	G.E.	Slipring	2200/440	600
300	G.E. (2)	Synch.	2200/440	360
300	Whse.	Slipring	2300	514
300	Whse.	Synch.	440	1200
250	G.E.	Sq. Cage	2200/440	1200
250	G.E.	Sq. Cage	2200/440	450
250	Gen. Elec.	Sq. Cage	440	3600
250	G.E.	Sq. Cage	2200	1800
250	Whse.	Sq. Cage	2300/440	600
250	G.E.	Slipring	440	600
200	L.A. TEFC	Sq. Cage	440	1200
200	G.E.	Slipring	2200	900
200	Reliance b.b.	Sq. Cage	220/440	1800
200	Allis Ch.	Slipring	440	450
200	Allis Ch.	Slipring	2200/440	720
200	Whse.	Sq. Cage	2200/440	900
150	G.E. (4)	Slipring	2200/440	600
150	Cr. Wheeler	Sq. Cage	220/440	450
150	G.E. (2)	Sq. Cage	2200/440	1800
150	Whse.	Slipring	220/440	1200
150	G.E.	Sq. Cage	2300	900
125	F.M. b.b. (2)	Sq. Cage	220/440	1800
125	El. Machy. (2)	Synch.	220/440	400
125	G.E. T.E.F.C.	Sq. Cage	2200	3600
125	Al. Ch. TEFC	Sq. Cage	220/440	900
100	Whse. (2)	Sq. Cage	2200/440	720
75	G.E. b.b. (8)	Sq. Cage	220/440	1200

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
200	Gen. Elec.	RC	250	1450
150	Whse.	SK-184	250	1150
150	Cr. Wh.	CCD	250	650
75	Gen. Elec.	CD-123	125/250	1200
75	Whse. b.b.	SK-123L	250	1800
60	Ideal	D	125	1150
60	Reliance b.b.	262-T	250	1200
50	Gen. Elec.	CD-113	125	1200

D. C. MOTORS

HP	Mfr.	Type	Volts	Speed
250	Cr. Wh.	101-H	230	1150
200	G.E. (2)	RC-38	230	1150
200	Whse. b.b.	SK	250	287/575
150	Whse.	SK-184	230	850
150	Whse.	SK-210	230	320/1000
150	G.E. b.b. dyn.	TLC-50	250	1750/3500
125	G.E.	CD-173	230	575/1150
100	Elliott b.b. T.E.	JH-FE	230	1150
80	Whse. dyn. b.b.	SK-123L	230	1800/5000
75	Whse. (4)	SK-163	230	500/1500
60	G.E. TEFC b.b.	CD-135	230	1150
50	Century	DN-314	230	1150/1750
50	G.E.	RF-16	230	250/1000
40	Whse. b.b. (2)	SK-163	230	300/1200
25	Whse. (2)	SK-153	230	300/1200

MOTOR-GENERATOR SETS

KW	Mfr.	Input V	Output V
600	Allis Ch.	440 AC	250 DC
300	Whse. (2)	2200/440 AC	250 DC
200	Gen. Elec.*	230/440 AC	125 DC
125	Gen. Elec.*	2300/4000 AC	250 DC
100	Gen. Elec.	220/440 AC	250 DC
75	Star b.b.	220/440 AC	250 DC
75	G.E.	200/440 AC	125 DC
60	Allis Ch.	220/440 AC	250 DC
50	G.E. b.b. (3)	220/440 AC	250 DC
40	Ideal	220/440 AC	250 DC

Arthur Wagner Co. Certified

MO nroe 6-7409

1435 W. RANDOLPH ST

CHICAGO 7, ILLINOIS

TRANSFORMERS—60 CYCLE

Qu	KVA	Make	Type	Phase	Voltages
2	3000	Moloney	TCR	3	7200/6600-4160/2400
2	750	G.E.	K	1	4600-120/240
1	750	Niagara	Air Cooled	3	2400/4160-480/277
1	300	Penna.	(Askarel)	3	12470Y/7200-240
2	250	G.E.	H Pyranol	1	4800/3820Y/120/240
2	250	West.		1	2300/4600-230/460
3	100	G.E.	HS		2400/4160-240/480
3	50	G.E.	H	1	2400/4160-240/120
1	50	Amer.	Abestol	3	4160-120/208Y
4	25	West.	Hypersil	1	2400/4160-120/240
3	75	G.E.	KF	1	2400/4160-120/240
9	25	G.E.	Dry	1	480/240-240/120
6	37½	G.E.	Dry	1	480/240-240/120
3	200	G.E.	HSW2F	1	2400/4160-240/480
2	333	West.	S.	1	4150-480/240

MOTOR GENERATOR SETS

Qu.	KW	Make	Speed	DC	AC
1	75	EM	1200	25	Syn. 220V.
1	75	G.E.	1200	125	2300/4160 Syn.
2	100	West.	1200	250	2300/4160Y Syn.
1	175	West.	1200	125	4150 Syn.
1	300	G.E.	1200	250	2300/4160Y SR
1	300	G.E.	1200	250	440 Syn.
1	1000	West.	720	600	2300/4160Y

ENGINE GENERATOR SETS

1—Hercules Gas HXE 62.5 KVA Westghe 3/60/480 —1200

1—Wisconsin Gas (Air) PE-99 7.5 KVA Master 1 or 3/120—2200 r.p.m.

SLIP RING MOTORS

Qu	HP	Make	Speed	Type	Volts
2	40	West.	690	CW	220/440
1	60	G.E.	1800	MT	220
1	75	G.E.	600	IM	440
1	100	West.	1800	T.E.F.C. B.B.	220
3	150	Allis-Ch.	1800	AY-RW	2300
1	200	West.	514	CW	440
1	250	West.	600	CW	440
1	350	West.	1800	CW	2300
1	500	G.E.	450	MT	2200
1	500	G.E.	1200	M569Z	2300/4160Y

D.C. MOTORS—230 VOLTS

Qu	HP	Make	Speed	Type
1	92	West.	425/1000	173 FR
1	250	G.E.	1200	Pedestal
1	30	G.E.	1750	SK 113

SQUIRREL CAGE MOTORS, 3 PHASE, 60 CYC.

1—275 HP, 1180 RPM G.E. Type KT 559BS 2200V
2—200 HP, 1790 RPM, G.E. Elec. KF, TEFC, 2300V
1—150 HP—1130 RPM. West. CS—2300V. Linestart B.B.
1—150 HP, 690 RPM, G.E. KT 562—440 V.

MOTORS—SYNCHRONOUS—3 ph. 60 cy.

100 HP 900 RPM G.E. Fom BL 2200 V.
125 HP 600 RPM G.E. Type TS 2200 V.
125 HP 900 RPM G.E. Type TS 4800 V.
150 HP 1800 RPM G.E. Type TS 220 V.
325 HP 900 RPM West—2300 V.
300 HP 720 RPM Elec. Machinery t.e.f.c. 2300 V.
400 HP 450 RPM Westinghouse Type HR 440 V

525/600/1200 HP Sectional Hdr. Boilers
100 HP Kewanee w/Burner—1953
500 HP C/B Oil/Gas Fired Boiler
50—70—80 HP Erie City Boilers
25 & 150 HP HRT Boilers
20 HP Kisco 100# Gas/Oil Fired Boiler
48" & 60" Smoke Stacks—Taken Down
150 HP Slip Rg. Motor at 1200 RPM

H. & P., 6719 Etzel, St. Louis 14, Mo.

DeLaval Boiler Feed Pump—Size LC-315J
Turbine & Pump 4650 RPM—540# steam
15# Back Pressure—675 GPM @ 725# press.
New, Unused with spare parts
2—Elliott Deaerating Feed Tanks—246,500#/hr.
1,000 gal. capy.—New, Unused—Monel Construction

LEWON BROS. 360 Bayshore Blvd., S.F. 24, Calif. Phone At 2-2726

"FOR POWER"

J.L. HEMPHILL & CO.

1603 54th STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-2727

PHONE NEW JERSEY—UNION 5-2848

37 Years Dependable Service

SLIP RING MOTORS 3-Ph., 60 Cy.

H.P.	Volts	Make	Speed
500	4000/2300	G.E.	600
450	440	Whse.	514
400(2)	2300	G.E.	900
400	4000/2300	Whse.	720
300	4000/2300	G.E.	720
300	2300	G.E.	900
300	440	G.E. (hoist)	600
300	440	Whse.	3600
225	4000/2300	G.E. (hoist)	600
200	2300	G.E.	600
200	2200/440	G.E.	720
150	220/440	Whse.	720
125	2300	G.E.	600

AC GENERATORS or SYN MOTORS, 60 Cy.

H.P.	Volts	Make	Type	R.P.M.
400	2200/440	G.E.	ATI	720
300	2200/440	G.E.	TS	1200
200	2300/440	Whse.	G	1200
150	440/220	Whse.	G	1200
150	440/220	G.E.	TS	900
125	440/220	Whse.	HR	400

SQUIRREL CAGE MOTORS

500	2200/4000	Elliott	SC	1800
350	2300/4000	G.E.	SEDP	3600
350	2300/440	G.E.	IE-K	1200
300(2)	2300	G.E.	FT	3600
300	2300/4000	L. Allis	FS	1800
300	2300/400	G.E.	KT	600
250	2200/440	G.E.	K	1200
250	2300/4000	G.E.	K	720
200	440/220	G.E.	KT	1800
200	2200	G.E.	KT	1800
200	2200	Cont.	TEFC	3600
200	440/220	G.E.	KT	720
150	440	Whse.	X-pf.	3600
150	440/220	Cont'l.	X-pf.	1800
150	440/220	G.E.	TEFC	720
150	2200/440	G.E.	AR	1800
150	2200/440		KT	600
150	2200/440	G.E.	FT	1200
125	2200/440	G.E.	K	600
100(2)	4000/2300	L. Allis	OX	1200
100	2300	Cont'l.	TEFC	3600
60(2)	440	Cont'l.	X-pf.	1800

CIRCUIT BREAKERS, 3 Pole

4—1600 Amp., DA-50, Whse., 600 V., Air
1— 600 Amp., Al. Chal., 15 KV
6— 600 Amp., R. Smith, 7.5 KV, Sol. oper.
1— 400 Amp., R. Smith 7.5 KV, outdoor, New

D. C. MOTORS

H.P.	Volts	Make	Type	Speed
200	230	Cr. Wh.	CMC	1200
150	230	El. Dyn.	B/brg.	600
125	230	G.E.	CD	600
60/75	230	G.E.	CD	500/1500

MOTOR GENERATOR SETS

KW	Make	Input V., AC	Motor Type	Output V., DC
300	Whse.	4150/400	Syn.	250/125
250	Whse.	440	Syn.	250
125	G.E.	440/220	Sq. Ca.	125
125	G.E.	440	Sq. Ca.	250/125
100	G.E.	2200/440	Syn.	250
75	Cr. Wh.	440/220	Sq. Ca.	240/120
65	G.E. B	2200/440	Sq. Ca.	250

TRANSFORMERS 60 Cy.

1—500 kva, Al. Ch., 2400/4160Y—600 volts, 3 ph.
3—500 kva, G.E., 13800—2300 V.
3—500 kva, G.E., 13800—240/480 V.
3—333 kva, American , 2400—240/120 V.
1—200 kva, Al. Ch., 6900—220 V., 3 ph.
1—200 kva, G.E., 2400—120/240 V., Pyr.
3—200 kva, Mol., 13,800—2300 V.
3—200 kva, G.E., 13,800—480 V.
3—200 kva, G.E., 4156—480/240 V.
3—167 kva, Whse., 4156—480 V.
3—150 kva, Al. Ch., 2400—220 V.
3—150 kva, Al. Ch., 440-220 V., dry New
3—150 kva, G.E., 13,200—2300 V.
3—100 kva, Whse., 4800/2400-240/480 V., Dry
3—100 kva, G.E., 2400—120/240 V., Pyr.

GASOLINE—ENGINE GENERATOR SETS

2—35 kva, 900 R, 220 V, 3 ph. conn. LeRoi, 6 cyl.
only partial listing

STEPHEN HALL & CO.

HARRY J. RICE, Pres.

625 ADAMS ST., HOBOKEN 2, N. J.

1902 COMPRESSORS 1959

WORLD'S BEST REBUILTS

70 CFM 1500 psi 9x8 Norwalk TDS3T
100 CFM 125 psi 6x7 Ing. ESI
138 CFM 100 psi 7x7 Ing. ES-I
162 CFM 120-500 psi 7½x13 Worth, St Booster
191 CFM 300 psi 9-4¼x9 CP TB2
238 CFM 100 psi 9x9 Worth. H. B. Ing. ES
268 CFM 500 psi 10-4¼x10 Ing.
311 CFM 1500 psi 10½-7⅛-3½x18 Ing. ES3
321 CFM 125 psi 10x11 Ing ES
465 CFM 100 psi 12x11 Ing.
583 CFM 100 psi 15-9¼x12 Ing. XRE 3-60-4160
628 CFM 100 psi 14x13 Ing ES Penn 3AT
676 CFM 100 psi 15-9¼x12 Ing. XRB
690 CFM 125 psi 13½-8x7 CP YCE
798 CFM 125 psi 14½-9x7 Ing XLE
920 CFM 110 psi 18-11x12 CP-OCE
7950 CFM 200 psi 33-17¾x27 IR PRE2 4C 1750 HP 3-60-2300

AMERICAN AIR COMPRESSOR CORP.
Dell Ave. & 47th St. North Bergen, N. J.
UNion 5-4848

BOILERS

1—B & W—90,000#s—800 psi
1—B & W—90,000#s—260 psi
2—B & W—85,000#s—250 psi
1—B & W—70,000#s—450 psi
1—Riley—60,000#s—290 psi
3—B & W—55,000#s—400 psi
1—B & W—50,000#s—200 psi
1—Union—50,000#s—250 psi
1—Bigelow—50,000#s—200 psi
1—B & W—40,000#s—675 psi
2—B & W—28,000#s—160 psi
2—B & W—25,000#s—500 psi
10—B & W sectional header boilers

Midwest Boiler & Turbine Co.
520 - 5th Avenue

THE BOSTON METALS COMPANY

Oldest Shipbreaking Firm in the U.S.A.

OFFERS NEW EQUIPMENT FROM THE UNCOMPLETED

BATTLESHIP U.S.S. KENTUCKY

Equipment installed but never used — all built to Navy standards of finest materials

TREMENDOUS SAVINGS ON ALL POWER EQUIPMENT!

PUMPS

10 MAIN FEED PUMPS

PUMP: Ingersoll-Rand — size 5" — three stage — capacity 500 GPM @ 750# discharge pressure. B.H.P 330 — 5000 RPM. *TURBINE:* Worthington-Moore — design pressure 575#/sq. inch — non-condensing — back pressure 20# — 5000 RPM — 330 B.H.P.

GEARED TURBINE-DRIVEN MAIN FEED BOOSTER PUMPS

PUMP: Mfg. by Buffalo Pump Co. — vertical single stage — capacity 550 GPM — 30# discharge — 8" suction — 5" discharge. *TURBINE:* 1 stage impulse — type Y-W — vertical — design steam pressure 575# — back pressure 20# — 12.5 HP — 5500/1750 RPM — mfg by Terry Steam Turbine Co.

2 MAIN FEED BOOSTER PUMPS

Same as geared turbine driven main feed booster pumps above, but with 14.5 HP 440/3/60 AC Star motor & Ward Leonard control. Across-the-line starter with pushbutton.

8 GEARED TURBINE-DRIVEN VERTICAL CONDENSATE PUMPS

PUMP: Main condensate 2-stage vertical pump — mfg by Buffalo Pump Co. *Capacity:* 375 GPM — 70#/sq. inch discharge pressure — 1150 RPM — 22.5 BHP — 9" suction — 4" discharge. *TURBINE:* Single stage — 575# working pressure — 20#/sq. inch back pressure — 22.5 HP — 5360/1150 RPM — Mfg. by Terry Turbine Co.

2 AUX. FEED BOOSTER PUMPS

PUMP: Vertical — mfg by Buffalo Pump Co. — 200 GPM — 30# discharge pressure. *MOTOR:* 7.36 HP — 1800 RPM — 440/3/60 — Star motor, with control.

BRONZE RECIPROCATING STANDBY FEED PUMPS

11 x 8 x 18 — mfg by M. T. Davidson Co. — vertical simplex — capacity 180 GPM — 800/900# discharge pressure — 575# working pressure.

4 TURBINE-DRIVEN FIRE AND FLUSHING SERVICE PUMPS

PUMP: Worthington — horizontal centrifugal. *Fire Service:* 750 GPM capacity — 150 PSI discharge pressure — 3500 RPM. *TURBINE:* single impulse — type B-20 — mfg by B. F. Sturtevant — design steam pressure 575# per sq. inch non-condensing. Back pressure 15# — B.H.P. 80/90.

3 GEARED TURBINE-DRIVEN MAIN CIRCULATING PUMPS

PUMP: Mfg. by Worthington Pump & Machinery Co. — 28" type — vertical single stage — bronze. *Capacity:* 28,000 GPM — discharge pressure 13.5# — 600 RPM — 267 BHP — 28" suction — 28" discharge — 8.5:1 gear ratio. *TURBINE:* single impulse — vertical type — 575# design steam pressure non-condensing — back pressure 15#/sq. inch. RPM 5100 pinion — 600 gear. Reduction gear ratio 8.5:1 — 267 BHP — mfg by B. F. Sturtevant.

3 MOTOR DRIVEN MAIN CONDENSATE PUMPS

Mfg. by Buffalo Pump Co. — vertical 2-stage — 375 GPM — 70#/sq. inch discharge pressure — 1150 RPM. *Motor Data:* 25 HP — 440/3/60 — 1150 RPM — Star Electric Motor Co. — with across-the-line starter, with pushbutton station — mfg by Ward Leonard.

8 GEARED TURBINE-DRIVEN MAIN LUBE OIL PUMPS

Mfg. by Northern Pump Co. *PUMP:* Vertical rotary type — 750 GPM — 55#/sq. inch discharge pressure — 263 RPM — 35 BHP — oil viscosity 130 to 500 S.S.U. — 7" suction — 6" discharge. *TURBINE:* Single stage — 575# design pressure non-condensing — exhaust pressure 15# — 35 BHP — 26.39:1 gear ratio — 6940 RPM.

4 TURBINE-DRIVEN GEARED FUEL OIL BOOSTER PUMPS

Mfg. by Northern Pump Co. — vertical rotary — 300 GPM — 150# discharge pressure — 282 RPM — 47.3 BHP — Oil viscosity 70-700 S.S.U. — 7" suction — 5" discharge. *DRIVE:* single stage impulse — 575# non-condensing — 15#/sq. inch discharge pressure.

6 FUEL OIL SERVICE PUMPS

Mfg. by Northern Pump Co. — vertical rotary — 85 GPM — 350# discharge pressure — 560 RPM — 27.4 BHP. *TURBINE:* 1 stage — 575# non-condensing — exhaust pressure 15# — mfg. by Northern.

VALVES

THESE ARE JUST A FEW OF THE MANY VALVES OFFERED. ALL TYPES ARE AVAILABLE INCLUDING REDUCING—SENTINEL—RELIEF—MICROMETER—PRESSURE REGULATING — ANGLE, ETC! STEEL—600# SERVICE—SEND US YOUR REQUIREMENTS FOR QUOTATIONS

LESLIE 2" GOVERNOR VALVES

Type C.P. — class A — capacity 7640#/hr. — 575# steam pressure — 750# discharge pressure.

MOTOR OPERATED GATE VALVES

Low Pressure — comp. geared — 38" — mfg by Chapman Valve Co. *MOTOR DATA:* H.P. 18 ft. lbs. running torque — 45 ft. lbs. max. starting torque — 440 volts 900 RPM 3 phase 60 cycle. Type: Submersible Valve Brake — Motor: Star Electric Co.
Also available, same as listed, but 36", and 28" inch as listed, but with smaller motor.

MISCELLANEOUS

AIR COMPRESSORS AND BLOWERS

18 WIDE RANGE FORCED DRAFT TURBINE-DRIVEN BLOWERS

9 R.H. — 9 L.H. — mfg by B. F. Sturtevant — propeller fan type — capacity 29,500 CFM/5540 RPM/250 BHP — 8250# steam/hr. — and, 9,000 CFM/1985 RPM/9 BHP — 690# steam/hr. — 7 blades — static: max 35" water — normal 21.5" water. Driven by Sturtevant turbine type VC-7 — non-condensing — single stage — 250 HP — 575# steam pressure — 15# PSIG exhaust pressure.

2 HIGH PRESSURE AIR COMPRESSORS, MOTOR DRIVEN THROUGH REDUCTION GEAR

Mfg. by Hardie Tyne — vertical reciprocating type — single acting — 30 cu. ft. @ 3000# discharge pressure — 4 stage — bore 7¾ x 6½ x 2 31/32 x 1½ — stroke 6" — 3 intercoolers — 450 RPM. *MOTOR:* 75 HP — 440/3/60 — 3550 RPM — frame 441 — mfg by GE — class High Shock.

2 LOW PRESSURE AIR COMPRESSORS

Mfg. by Gardner-Denver — vertical tpye — 101 CFM @ 100# discharge pressure — 2 stages — 5¾ x 4¾ bore — 5" stroke — 870 RPM — 25 BHP. *MOTOR:* 28.6 HP — 900 RPM (sync) — 440/3/60 — mfg by Diehl — with Cutler-Hammer control.

LUBE OIL COOLERS

4 — mfg by Westinghouse. 1600 sq. ft. cooling surface — cylindrical straight-tube horizontal type. Oil capacity 590 GPM — water capacity 1500 GPM — temp. oil inlet 150°F — outlet 120°F — temp. water inlet — 85°F — outlet 90°F. Number of ⅝" tubes 816 — Wall 0.049 TK — Cupro-Nickel.

MAIN CONDENSERS

Mfg. by Foster-Wheeler — 23,500 sq. ft. cooling surface — 40,500 GPM circulating water — total tubes 8,976, of cupro-nickel, as follows: (550) each ⅝" x 0.066 and (8416) each ⅝" x 0.049. Monel water boxes.

BOILERS

7 B&W EXPRESS TYPE

Design pressure 634# — operating pressure 565# — temp. 850°F. Oil fired — separately fired superheaters. *Capacity:* 210,000 lb. steam/hr. Ideal for testing where large quantities of steam are required, giving excellent control from separately fired superheaters.

3 GLAND EXHAUST CONDENSERS

Foster-Wheeler — total capacity lbs./hr.: 1200 lbs. steam and 350 lbs. air — 155 sq. ft. — 4" ejector.

LARGE DEAERATING FEED HEATERS

Monel construction — spray type — capacity 480,000 lbs./hr. — vertical condenser — single pass — heating surface 174 sq. ft.

GE HIGH AND LOW PRESSURE MAIN PROPELLING TURBINES

WILL SELL SEPARATELY FOR TESTING, WIND TUNNEL OR SIMILAR WORK. *(2) High pressure* — 24,400 HP — 12 impulse stages — 4909 RPM — working pressure 540# — 825°F. *(2) Low Pressure:* 28,600 HP — 3913 RPM — working pressure 49# steam — 424°F — 2-6 stages of impulse.

THE BOSTON METALS COMPANY

313 East Baltimore Street
Phone: ELGIN 5-5050

Baltimore 2, Maryland
Phone: LEXINGTON 9-1900

FROM AIRCRAFT CARRIER
"ENTERPRISE"

[4] 1000 KW
GEARED
TURBO-GENERATORS

For Condensing
or Non-Condensing

1000 KW TURBO-GENERATOR
COMPLETE WITH CONDENSERS
CIRCULATING PUMPS
CONDENSATE PUMPS
AND SWITCH GEAR

GENERATOR: 1000 KW—type ATB-2—G.E.—form H.L.—1250 KVA—3/60/450—1605 amps—3600 RPM—0.8 P.F.—field amps 67—typical serial No. 5358205—with 120 volt 11KW DC exciter—compound wound.

STEAM TURBINE: 1000 KW G.E.—type FSN-4R-FN30-85TG—rated 7964 RPM—exhaust 1 lb. absolute when condensing.

REDUCTION GEAR: S-118—form A—RPM 7964/3000.

TURBINE STEAM PRESSURE: 375 lbs—175°F superheat-exhaust pressure 1 lb. absolute when condensing. Can be used condensing or non-condensing.

BUILT AS MARINE UNITS USING FINEST MATERIALS. DRIP - PROOF CONSTRUCTION. UNITS ARE 16' LONG—7'8½" WIDE. MOUNTED ON PRE-FAB SUB-BASE.

OPERATING CONDITIONS

1. The turbines are designed for normal operation condensing at 375 lb per sq in gauge, 175°F superheat steam at throttle, and 1 lb. per sq. in. absolute at the turbine exhaust flange.
2. The turbines will operate successfully condensing at 375 lb. per sq. in gauge, 0°F superheat at throttle, and 1 lb. per sq. in. absolute back pressure at the turbine exhaust flange.
3. The units have an overload capacity of 25% (1250 KW, 0.80 p-f) for two hours with normal main and exhaust pressures.
4. The units have an overload capacity of 50% (1500 KW, 0.80 p-f) for five minutes with normal main and exhaust pressures.
5. The units will deliver normal output (1000 KW, 0.80 p-f) with main pressure 20% below normal and with a back pressure of 2 lb. per sq. in. absolute at the turbine exhaust flange.
6. The turbines will operate successfully with a maximum main pressure of 450 lb. per sq. in. gauge and with a maximum superheat of 200°F at the throttle.
7. The turbines will develop 500 KW with 375 lb. per sq. in. gauge, 175°F superheat steam at throttle, and 29 lb. per sq. in. gauge back pressure at the turbine exhaust flange.
8. The turbines will operate successfully when extracting steam from the second-stage shell of the turbine. An automatic pressure regulating valve and a non-return valve should be installed in the extraction line to hold the extraction steam at approximately 10 lb. gauge and to prevent a return flow of steam to the turbine.
9. The turbines will operate successfully with full steam flow to atmosphere.
10. The units will cover the entire range of conditions as listed above under automatic control of the speed governor.
11. The steam flow to the throttle is guaranteed not to exceed the amounts listed in Part V for the given loads when operating with steam at 375 lb. per sq. in. gauge at throttle, 175°F superheat, and 1 lb. per sq. in. absolute at the turbine exhaust flange. The guaranteed steam flows include the necessary steam for sealing the packing glands, and includes the electrical losses for the exciter fields and rheostats.

THE BOSTON METALS CO.

313 E. Baltimore St. Baltimore 2, Md.
ELGIN 5-5050 LEXINGTON 9-1900

O'BRIEN MACHINERY CO.

WE OWN AND OFFER
FROM OUR PHILADELPHIA SHOPS

MOTOR GENERATOR SETS

500 K.W. West. 125/250V. 900 RPM—720 H.P. West. Syn. Mtr. 3/60/480 V.
250 K.W. GE—MPC—250 V.—1200 RPM—400 H.P. Syn. 3/60/480
150 K.W. West. 250 V. DC 1200 RPM. 225 H.P. West. Syn. 3/60/480/2300/4160 V.
100 K.W. Star B. Brg. 250 V. 1800 RPM—150 H.P. Syn. Mtr. 3/60/220/440

TRANSFORMERS—OISC—1 PHASE

3—750 KVA West. 33000-2300
5—667 KVA G.E. 13200-2300
3—500 KVA G.E. 13200-2300
3—333 KVA PENNA. 7200-480/240
6—250 KVA G.E. 2400-240/480

BOILERS

1—200 H.P. Titusville—Iron Fireman Automatic Scotch Package 150 psi—Hy Oil—Brand New—Immed. Shipment.

AIR COMPRESSORS

2—7500 C.F.M. Ing. Rand XHE 31½x31½x14. 30 p.s.i. 600 H.P. E.M. Syn. 3/60/2300/300 RPM (1948)
1—1100 C.F.M. Ing. Rand XPV, 18x11x14 Steam Drive (1948) 100 psi
1—515 C.F.M. Ing. Rand 90 Model 40 125 psi. V-Belted 100 H.P. 3/60/220/440 Motor on Base

GENERATOR SETS

1—375 KVA—G.M. 8-268—3/60/480 1200 RPM—Diesel
3—800 K.W. G.E.—Steam Turbo—3/60/450 3600 RPM 400 psi. Condensing
1—250 KVA G.M. Twin 6-71 Diesel Rad. Cooled 3/60/480—1955
1—156 KVA Cummins Diesel 3/60/240 Rad. Cooled—New 1956—Never Used
1—125 KVA Cummins Diesel 3/60/240 Rad. Cooled—New 1956—Unused
1—75 KVA Hercules Diesel 3/60/240/480

THE O'BRIEN MACHINERY CO.

PHILADELPHIA'S LEADING
MACHINERY DEALERS & EXPORTERS
1915 W. CLEARFIELD ST.
Phila. 32, Pa. BA 8-1480

THE O'BRIEN MACHINERY CO.

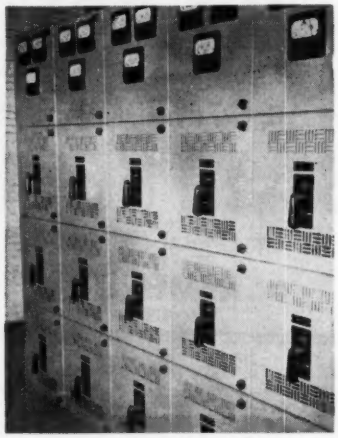
DE MEXICO S.A. de C.V.
116 Poniente Building F
Industrial Vallejos, Mexico, D.F.

DIESEL ENGINES & GENERATOR SETS

Partial view of vast stock of 400 hp to 2000 hp engines and 300 kw to 1500 kw generator sets to meet your every need. Available for immediate shipment.

A. G. SCHOONMAKER *Company, Inc.*

Foot of Spring St., Sausalito, Calif.
EDgewater 2-1490
50 Church St., New York 7, N. Y.
Digby 9-4350



COMPLETE SUBSTATION & DISTRIBUTION PANEL

Westinghouse—5 years old

3—167 KVA Transformers 13.8 KV-440V with disconnect switches; 1—3p 2000A elec. oper. Air Circuit Breaker; 1—3p 600A and 17—3p 300A 600V ABC's—all in dead-front cabinets; associated ammeters, volt meters, ground detector, pot'l and current transf's and busses. 2—240 KVAR banks of capacitors with D. C. breakers. Will sell as unit.

WHITE FUEL CORPORATION
BOSTON 27, MASS.

BOILERS

4—1006 HP Babcock Wilcox Sect. Head.
2— 755 HP Babcock Wilcox Sect. Head.
2— 502 HP Babcock Wilcox Sect. Head.

ARG CHEMICAL MACHINERY S.A.
507 FIFTH AVENUE, NEW YORK, N.Y.

OPPORTUNITIES!

In

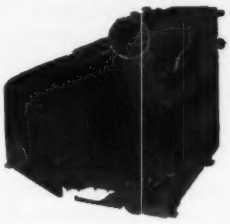
New and used equipment recently released from service by a number of electric and gas utility companies

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list . . . to

EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE
Two Rector St., New York 6, N. Y.

BOILERS NEW UNASSEMBLED



# Steam/hr.	Key	PSI	Temp.
122,500	DF	565	850
121,650	DF	565	850
60,000	SF	435	750
74,000	H	280	500
55,000	A	240	—

DF Double Furnace, SF Single Furnace (illustrated), bent water tube boilers w/economizers and superheaters, B & W's and Foster Wheelers.

H Header type, straight tube, B & W.

A 3 drum, single furnace, Wickes.

Polnik-Loconti Industrial Supply, Inc.

315 Oriskany St., Yorkville, N.Y.

E Utica, N. Y. Ph. RE 6-4621, RE-2-4513

FOR SALE

ONE BAROMETRIC CONDENSER

originally used with 1100 HP condensing steam engine using 1500 GPM of cooling water. Condenser is complete, including structural support from ground, tail pipe, and miscellaneous piping. Can be seen at

817 Corinth Street, Dallas, Texas

LIQUIDATION

2—3750 KVA West. Turbo-Gen. 3/60/2400, 3600 rpm, cond.
1—600 KW Al. Ch. Turbo-Gen. 3/60/440, 3600 rpm, non-cond.
1—500 KW El. Mach. Gen. 3/60/440, 327 rpm.
1—150 KW Ridgway M.G. Set, 125V D.C., 440V A.C., 850 rpm.
1—125 KW West. M.G. Set, 125V D.C., 440V A.C. 570 rpm.
75—A.C. motors, 5 to 300 HP.
40—Cleveland, Link Belt Reducers, 1 to 25 HP, ratios 285-1 to 70-1.
12—Transformers 50 and 200 KVA, 2400/440 volts.
1—600 HP Worthington Gas Engine.
1—475 cfm I.R. Comp., Imperial, 200 psi, 125 HP motor.
1—150 cfm I.R. Comp., XRB, twin stage, 175 psi, 30 HP motor.
1—Kerr Steam Turbine, 125 HP, 150 psi, 200 rpm.
1—Moore Steam Turbine, 100 HP, 110 psi.

BRILL EQUIPMENT COMPANY
2401 Third Avenue, New York 51, N. Y.
Tel.: CYpress 2-5700.

"FASTER FROM FOSTER"
RAIL
& ALL TRACK EQUIPMENT
Nation's Largest Warehouse Stocks
L. B. FOSTER CO.
PITTSBURGH 30 • ATLANTA 8 • NEW YORK 7
CHICAGO 4 • HOUSTON 2 • LOS ANGELES 5

IN CANADA

Surplus boilers of all kinds also generating equipment.

C. R. CAMPBELL & CO. LTD.
3077 Bathurst St., Toronto 19

WE'RE IN LINE FOR '59

GAS & DIESEL GENERATORS

11—1250 KVA Natural Gas Engine Sets 3/60/2400/4160 with switch gear *(can be seen running)*
1—625 KVA Clark RA-8 Gas Engine 3/60/2400
1—500 KW Cooper Bessemer Model JS 6 cylinder Diesel 3/60/2400

BOILERS

3—1296 HP B&W Sectional Steel Headers 275 PSI Gas/Oil Fired
1—75000#/hr 650 PSI 650°F Oil Fired C.E.
1—25000#/hr 450 PSI 738°F Stirling, Stoker
4—200 HP 160 PSI Keeler, Stoker Fired
12—NEW UNASSEMBLED B&W, F.W., C.E. with Superheater, Economizer, Soot Blowers, Oil Burners, Steel Encased — Rated:
122,500#/hr, 565 PSI, 850°F
44,500#/hr, 450 PSI, 735°F
35,000#/hr, 285 PSI, 577°F

TRANSFORMERS

1—6000 KVA Sub-Station 3/60/44000-4160
2—1500 KVA 3 phase, 34,500-460 G.E.
3— 500 KVA 66000-460 Single phase
3— 75 KVA 4600-115/230 Single phase
2— 50 KVA 440-120/240 Single phase

PUMPS

20000 GPM @ 60'—400 HP motor (2)
2600 GPM @ 173'—200 HP Vertical
1500 GPM @ 150'—125 HP Vertical
680 GPM @ 150'— 40 HP Vertical
8" Morris DREDGE Pump with 75 HP motor
1350 CFM Nash #7 VACUUM

TURBO GENERATORS

2—12,500 KW 275 PSI 610°F Condensing
1—2500 KVA Auto Extract Non Cond. 600 PSI, 650°F; 160 PSI Extract; 30# BP, 3/60/480
1—1875 KVA Condensing 400 PSI 700°F with Surface Condenser 3/60/2300
1—500 KW Condensing 200 PSI A.C. or D.C.
1—500 KW G.E. Non Cond. 265 PSI, 0-10# BP

MOTORS

400 HP West. Type CW 720 Slip Ring 440V
200 HP G.E. 1800 XP Vertical Hollow Shaft
150 HP G.E. 900 TEFC 440V
150 HP West. Type CW 1800 Slip Ring 440V
125 HP G.E. 1800 XP Vertical Hollow Shaft
75 HP West. Type CW 1800 Slip Ring 440V (2)
50 HP G.E. 1800/900 X.P. 440V (2)
50 HP Allis Chalmers 1800, 440V
40 HP G.E. 1800 XP Vertical Hollow Shaft
40 HP G.E. 3600 D.P. Vert Hollow Shaft (6)
30 HP G.E. 3600 D.P. Vert. Hollow Shaft (2)
30 HP West. Type CW 1200 Slip Ring 440V (2)

MISCELLANEOUS

40 Ton OET Crane, 10 Ton Aux.; 47' Span; 75' Lift; Cab Operated
Marley 3-24E-1 Cooling Tower 20,000 GPM
500 KW 120/240 1200 RPM West. Generator
600 Amp G.E. FKO227-50 Oil Breakers (2)
Worthington Deaerating Heater 35,000#/hr
Elliott Deaerating Heater 170,000#/hr
50,000 gal. Water Tower 100' high
16,000 sq. ft. West. Surface Condensers (2)

HEAT & POWER CO. Inc. **POWER EQUIP. DIV.**
60 East 42nd St., New York 17, N. Y.
310 Thompson Bldg., Tulsa 3, Okla.

NON-CONDENSING TURBINE GENERATORS

2500 KW Allis-Chalmers
400# I.S.P., 140# Ext.
30# B.P. — 3/60/480V.

2000 KW General Electric
600# 750° I.S.P. 150# B.P.
3/60/6600/4160 V.

CHARLES WEAVER, INC.

Phone:
BRoadway 3-1900

19701 James Couzens Hwy.
Detroit 35, Michigan

POWER EQUIPMANT

150 KW Crocker-Wheeler Motor-Gens. (2) Gens 250V-Motors 3/60-4600/2300V

150 KW General Motors Diesel Units 3/60 220/440V 1800 RPM—(3)

700 KW G.M. 12-567 Diesel Units (4) 3 ph., 60 cycle, 480/2400V

2000 KW GE N.C. Ext. Turbo - Gen. 480V, 600#, 650°, 150# Ext, 30# BP

BREW WOLTMAN & CO., INC.
50 Church Street, New York 7, N. Y.

AUTOMATIC and MANUAL
Gas or DIESEL GENERATOR UNITS
Complete Switchboard Design or Construction
USED & REBUILT EQUIPMENT
UNIVERSAL POWER ENGINEERING CO.
382 Wayne St. Jersey City, N. J.
Phone: DElaware 2-8300

FOR SALE
DIESEL ENGINE GENERATOR UNITS
DUAL FUEL & DIESEL ENGINE GENERATOR UNITS

1250 KVA (2) Worthington supercharged diesel engine generator units 3 phase 60 cycle 2400/600/480 volts 360 RPM
New 1949 — Excellent condition

1050 KVA Nordberg supercharged diesel engine generator unit 3 phase 60 cycle 2400 volts 327 RPM
New 1947 — Excellent condition

The above units are still installed and can be adapted for Dual Fuel operation.

INTERNATIONAL POWER MACHINERY CO.
1612 Union Commerce Building — MAin 1-9514
Cleveland 14, Ohio

UNUSED EQUIPMENT BUILT OF FINEST MATERIAL TO NAVY SPECIFICATIONS

TURBO-GENERATORS

1—3500 KW, 3/60/4000 Volt, 3600 RPM, 410 PSI, 28½" Hg vac, with 3800 sq. ft. condenser.

3—2250 KVA 3/60/2300 Volt or 4100 Volt, 3600 RPM, 410 PSI, 28½" Hg vac, with 3800 sq. ft. condenser.

CONDENSERS

A large assortment of 2-pass condensers, 400 sq. ft. to 3500 sq. ft. and tube jet air ejectors.

EVAPORATORS

3—8000 GPD Soloshell Evaporators, manufactured by Griscom Russell.

1—30,000 GPD, 3 effects, 3 shell manufactured by Griscom Russell.

2—40,000 GPD, 3 effect, 3 shell manufactured by Foster Wheeler.

DIESEL ENGINES

Used—Excellent Condition

4—GM 16-278A, 2880 shaft horsepower.

2—Fairbanks-Morse, 38D 81/8 OP, 1800 HP.

MOTORS

10—6000 HP, 3/60/2300 Volt or 4160 Volt, 514 or 257 RPM, synchronous.

4—1500 HP, 550 Volt, DC, 600 RPM.

DEAERATING HEATERS

8—246,500 lbs./hr, monel, manufactured by Elliott.

BOILER

1—253,000 lbs./hr steam, B & W, 550 PSI, 850° F superheated steam, double furnace, single uptake.

PUMPS

A large assortment of Condensate, Luboil, and centrifugal pumps.

FUEL OIL HEATERS

A large assortment of Griscom Russell fuel oil heaters, 42.1 sq.ft., 72.7 sq.ft. size AT-60, size AT-73.

HUGO NEU CORPORATION

45 NASSAU STREET **NEW YORK 5, N. Y.**

BOILERS

4—Keeler 200 HP, 160 psi, water-tube, w/acc.

COAL PULVERIZERS

1—Babcock & Wilcox #32E, 75 HP
1—Raymond 6-roll mill, 66" dia., 200 HP
3—Robinson #13 Sawtooth Crushers, 15 HP

COAL HANDLING CONVEYORS

4500'—16", & 24" all-steel trough rubber belt conveyor, complete units
150'-48" wide apron feeders

WRITE FOR DETAILS

PERRY EQUIPMENT CORP.
1422 N. 6th St., Philadelphia 22, Pa.
Phone: POplar 3-3505

FOR SALE

D.C. GENERATOR EQUIPMENT

Completely integreated steam driven D.C. generator equipment in excellent condition requiring only low pressure steam supply.

3—120 Volt—415 Amphere units
1—110 Volt—910 Amphere unit
1—230 Volt— 93 Amphere unit

Samuel W. Barrow
1321 Connecticut Ave., N.W.
Washington, D. C.

FOR SALE

300 KW, Ames Vert. Unif. Engine Generator 3 phase, 60 cycle. 240/480 V, 3600 RPM. Excellent condition. Attractively priced.

FS-1201, POWER
Class. Adv. Div. P.O. Box 12, N.Y. 36, N.Y.

SEARCHLIGHT Equipment Locating Service

No Cost or Obligation

This service is aimed at helping you, the reader of "SEARCHLIGHT", to locate Surplus new and used power equipment not currently advertised. (This service is for USER-BUYERS only. How to use: Check the dealer ads to see if what you want is currently advertised. If not, send us the specifications of the equipment and/or components wanted on the coupon below, or on your own company letterhead to:

SEARCHLIGHT EQUIPMENT LOCATING SERVICE
c/o POWER—Classified Advertising P.O. Box 12, New York 36, N. Y.

Your requirements will be brought promptly to the attention of the equipment dealers advertising in this section. You will receive replies directly from them.

SEARCHLIGHT EQUIPMENT LOCATING SERVICE, c/o Power, P. O. Box 12, New York 36, N. Y.

Please help us to locate the following used equipment:

.....

.....

NAME ..... TITLE ..... COMPANY .....

STREET ..... CITY ..... ZONE ..... STATE 5/59

ELECTRICAL POWER EQUIPMENT

A. C. MOTORS—3 ph. 60 Cy.

SLIP RING

Qu.	HP	Make	Type	Volts	Speed
1	1750	G.E.	M-579BS	4800/2400	1800
1	1500	G.E.	MT-6	6600	1197
1	800	Whse.	CW	550	1776
1	600	Whse.	CW-432D-15	440	1778
1	500	Whse.	CW	350	350
1	250	G.E.	MT-424Y	4000	257
1	250	Cr. Wh.	SIZE-290	2300	350
1	250	A.C.		550	600
1	250	G.E.	MT-563Y	440	875
1	250	Whse.	CW-1010	2200	435
1	200	Whse.	CW-874D	220	885
1	200	G.E.	IM	2200	580
1	200	G.E.	IM	2200	435
2	200	Whse.	CW-890	2300	1775

SQUIRREL CAGE

1	800	G.E.	KT-573	2200	1180
1	500	G.E.	FT-359AY	2300	3600
2	550	Whse.	CS-1115	2300	900
4	500	Whse.	CS-1216	2200	500
3	500	G.E.	KF	2300	3600
2	400	Whse.	CS	6600/4000	3565
1	400	G.E.	K-6344Z	440	1185
1	300	Whse.	CS-1002	2300	600
1	200	Whse.	CS-963H	2300	1175/878
1	200	G.E.	KT-557	440	1800
2	200	Whse.	CS-855S	220/440	1750

SYNCHRONOUS

1	7300	G.E.	ATI	2240/6600	600
1	3500	G.E.	TS-6438P	2300/4000	360
2	1750	G.E.	ATI	2300	3600
1	1750	G.E.	TS	2300	900

M-G SETS—3 PH. 60 CY.

Qu.	K.W.	Make	RPM	DC Volts	AC Volts
2	2100/1750	G.E.	514	250/350	2300/4600
1	2000	G.E.	514	660	2300/4600
1	1500	G.E.	720	600	6600/13200
1	1500	G.E.	600	600	2300/4150
1	1200	West.	720	600	2300/4160
1	1000	G.E.	900	260	6600
2	300	G.E.	1200	250	2300
1	500	G.E.	900	125/250	440
1	350	G.E.	900	125	440/4160
1	250	G.E.	900	250	220/440
1	240	West.	900	125	220/440
1	200	El. Mhy	1200	250	2300/4600
1	300	Whse.	1200	600	2300

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	300	G.E.	175/200# Cond. 480/2300 V.
1	1000	G.E.	150# no Cond 2400 V.
1	4000	G.E.	400# surface condenser 2400/4150 volts.

TRANSFORMERS

Qu.	KVA	Make	Type	PH.	Voltages
3	3333	Whse.	OISC	1	13800x2300
3	1000	G.E.	OISC	1	13800x460
2	750	G.E.	PYR.	1	55/255
2	500	Kuhl.	OISC	1	13200x6600
6	333	G.E.	OISC	1	7200/12470Yx2400/4160Y
3	100	L.M.	OISC	1	4160/7200Yx240/480

FREQUENCY CHANGER SETS

Qu.	KW	Make	Freq.	Voltage
3	6750	G.E.	60/25/60	13200/13200
1	5000	G.E.	60/50/60	11000/6600
2	2500	G.E.	25 cy/62.5	2300/2300

RE-NU-BILT BY

BELYEA COMPANY, INC.

43 Howell St., Jersey City 6, N. J.
Tel: OLDFIELD 3-3334

FOR SALE
14 NEW TURBINES

4 horizontal, 10 vertical, Westinghouse Driving forced draft blowers—capacities ranging from 39000 to 56000 CFM and 16" to 24" pressure. Steam pressures 360 to 575#, back pressure 10#.

Will sell turbines separately if desired.

Price reasonable.

Also—1—250 KW GE turbo generator unit, 3 phase, 60 cycle, 440 volt. Used one year.

G. M. De ROSE
2457 WOODWARD AVE.
706 DONOVAN BLDG.
DETROIT 1, MICH.

MISS POWER EQUIPMENT SAYS,
"For BIGGER SAVINGS and BETTER SERVICE, Get Our BARGAIN PRICES on Guaranteed New and Rebuilt Motors"

SQUIRREL CAGE MOTORS NEW AND GUARANTEED REBUILT

HP	Make	Type	Speed
500	L.A. B.B. Splash. 440 Volt	FX-1468	3600
500	G.E. S.B. Open	IK	1200
400	L.A. B.B. Splash		1800
400	G.E. S.B. Open	IK	1200
400	West. S.B. Open	CS	900
400	West. S.B. Splash 2800 Volt	CS-39B	720
300	G.E. S.B. Open	IK	1800
300	Ideal—B.B. Splash.	A-1475	900
300	G.E. S.B. Open	IK	900
300	G.E. S.B. Open	IK	720
300	West. S.B. Open	CS-1002	600
300	Reliance. B.B. Splash	AA-3085	600
250	G.E. S.B. Open	KT	1800
250	L.A. B.B. Drip.	OGX-117	1800
250	G.E. S.B. Open 2200 v	IK-16	1200
250	G.E. S.B. Open	IK	1200
250	G.E. S.B. Open	IK	900
250	G.E. S.B. Open	IK	720
200	Cont. T.E.F.C.B.B.	NP-686C	1800
200	West. S.B. Open	CS	1200
200	G.E. S.B. Open	IK-15	1200
200	G.E. S.B. Open	IK-15S	1200
200	G.E. S.B. Open 2200 v	IK	1200
200	G.E. S.B. Open	IK	900
150	West. TEFCBB XP	CS-773.6	3600
150	G.E. TEFCBB	K16328	3600
150	G.E. TEFCB XP	K	3600
150	Wst. S.S.B. Opn	CS-761C	1800
150	G.E. TEBB	K	1800
150	West. S.B. Open 220V	CS	1800
150	G.E. S.B. Open	IK	1800
150	Marathon. B.B. Drip	TDA-584	1800
150	G.E. B.B. Open	KT	1200
150	G.E. S.B. Open	IK	900
150	Cont. T.E.F.C. B.B. New		900
150	G.E. S.B. Open	KT-558	900
150	G.E. S.B. Open	IK	720
125	G.E. TEFCBB	K	3600
125	A.C. B.B. Open	ARX-505	3600
125	West. T.E.F.C. B.B.	CS-753	1800
125	West. S.S.B. Open New	CS-607	1800
125	G.E. S.B. Open	IK	1800
125	West. S.S.B. Open	CS	1800
125	West. T.E.F.C. B.B.	CS-855	1200
125	Howell B.B. Open	BB-481	1200
125	G.E. S.B. Open	KT-553	1200
125	G.E. S.B. Open	IK	1200
125	G.E. S.B. Open	IK	900
125	G.E. S.B. Open	IK	720
125	G.E. S.B. Open	IK	600
125	West. B.B. Open	CS-574C	600
100	Howell T.E.F.C.B.B.	K-505	3600
100	G.E. B.B. Drip	K-504	3600
100	G.E. S.B. Open	KT-343	1800
100	G.E. B.B. Open	K-504	1800
100	L.A. T.E.F.C.B.B.	JX-113	1800
100	G.E. S.B. Open	KT-347	1200
100	West. SSB Open	CS-607	1200
100	Wagner T.E.F.C.B.B.	CP-685	1200

CASH FOR YOUR SURPLUS

NEW & USED Electrical Equipment

•

SEND YOUR LIST TODAY!

FREE CATALOG. This is a partial listing. We are continually changing our stock, and can fill your requirements at any time. Send for our free catalog. In Stock, fractional horsepower up to 500.

Motors, Control Equipment, AC and DC Generators, MG sets and transformers.
PHONE or WIRE us COLLECT
LARGE LINE OF SLIP RING MOTORS & CONTROLS.

POWER EQUIPMENT CO.

8 CAIRN STREET • PHONE BEverly 5-1662 • P. O. BOX 534 • ROCHESTER 2, N. Y.

TRANSFORMERS

1—300, 1—200 KVA, 3/60/4160-240 Wagners, ITE type HPS Outdoor Unit Substations.
2—250 KVA, 1/60/2400-240/480 Moloney, OISC, type YC, W/taps.
1—250, 4—150 & 2—100 KVA, 1/60/4160-120/240 Whse. Inerteen w/taps.
1—200 KVA Wag. 1/60/2300-115/230
3—100 KVA 1/60/4160-240/480 Packard OISC
5—25 KVA, WHSE. 1/60/2400—240/480 OISC.
2—50, 6—37½ KVA, G.E. 1/60/2400-120/240 OISC.

CASH
For Surplus Electrical Equipment

BENSON-WILIMZIG, INC.
1704 North 8th St., St. Louis 6, Mo.
Phone GArfield 1-4290

TURBINE & DIESEL GENERATORS

3000 KW GE CURTIS. CONDENSING. 365# ISP. 200° FS 3/60/2300 VOLTS. NEW 1930. FULL AUXILIARIES. BARGAIN.

1666 HP BUSCH SULZER DIESEL. 8 CYL. 200 RPM. 1563 KVA WESTGHS. 3/60/2400 V. NEW 1938. FULL AUXILIARIES. EXCELLENT. REAL BARGAIN.

Other Sizes Available

WHISLER EQUIPMENT COMPANY
611 Olive St. St. Louis 1, Mo.
CHestnut 1-4474

GUARANTEED "REBUILT" POWER EQUIPMENT

SQUIRREL CAGE MOTORS

3 phase, 60 cycle, 220 or 440 volts (*2300 volts or higher)

H.P.	MAKE	TYPE	SPEED
1250	*Al.-Ch.	ANX	3600
600	West.	CS	720
600	*G.E.	K-63455	1200
500	*G.E.	K-63455	1200
500	*G.E.	I-13-E	900
350	*G.E.	KT-556-A	1800
300	*G.E.	K6344	1200
250	*W (TE)	CS-81205	1800
250	*G.E.	KT-509-S	1800
250	*West.	CS-875-S	1800
250	Brook	RS28	1200
200	*G.E.	FT-549	3600
200	*G.E.	I-K-13B	1800
200	West.	CSP-581-S	1800
200	Brook	RS-27	1200
200	*West.	CS-930-A	900
200	G.E.	KT-564-S	720
200	*Al.-Ch.	AN-37-B	720
200	*West.	CS-1010	600
200	Al.-Ch.	ARW-631	600
150	Cr-Wh.	SC-140	3600
150	Al.-Ch.	AN 30-F	1200
150	West.	CSP-5815	1200

M.G. SETS

Kilowatt	Make	Volts AC	Volts DC
1000	West.	4000	250
750	G.E.	4160	275
500	West.	440	250
400	Al. Ch.	2300	240
300	West.	2300	250
200	G.E.	2300	275
200	Rdgwy	2300	250
150	Al. Ch.	2300	275
150	West.	2300	250
125	Cr. Wh.	4160	125
125	G.E.	2300	250
100	G.E.	2300	250
100	Al. Ch.	2300	250
60	G.E.	220/440	250
40	G.E.	220/440	250

HUNDREDS OF BARGAINS in MOTORS, GENERATORS, CONTROL, HOISTS, COMPRESSORS, ETC.

SLIP RING MOTORS

3 phase, 60 cycle, 220 or 440 volts (*2300 volts or higher)

H.P.	MAKE	TYPE	SPEED
2500	*G.E.	MT (Mill Type)	257
1100	*G.E.	MT	720
1000	*G.E.	M-575-S	1200
1000	*West.	CW	450
600	*G.E.	M-6345-S	1800
500	G.E.	M-6345	1200
400	*G.E.	MTP-585	1200
350	*Al.-Ch.	ARYW	1800
300	Cr-Wh.	SR-76-R	1800
250	Al.-Ch.	ARY-626	1800
250	*G.E.	I-M-17A	720
200	G.E.	I-M-16	600
200	*West.	CW1950A	514
150	Cr-Wh.	SR-50R	1800
150	G.E.	I-M-15A	600
125	G.E.	I-M-15A	600
100	G.E.	I-E-13A	1800
100	G.E.	MT558	720
100	G.E.	I-M-15A	425
75	West.	CW-770	1200

WRITE FOR CURRENT STOCK LIST

CHICAGO Electric Co.

ALL TYPES OF EQUIPMENT IN STOCK

1320 W. CERMAK RD. • CHICAGO 8, ILL. • PHONE: CANAL 6-3900

Advertisers' Index

A

Air Preheater Corp. 149
Allen-Sherman-Hoff Co. ..... Second Cover
Allgemeine Elektricitats-Gesellschaft ..... *
Allis-Chalmers Mfg. Co. 121, 123, 125, 127, 129
Allis-Chalmers Mfg. Co., Hydraulic Div. 131
Allpax Company, Inc. 140
Alpha-Molykote Corp. ..... *
American Brass Co. ..... *
American Engrg. Co. ..... *
American Gilsonite Co. ..... *
American Hard Rubber Co. 90
American Meter Co., Pump Div. 106
American Pulverizer Co. 118
American Standard Industrial Div. 18-19, 30
Ames Iron Works 89
Anchor Packing Co. 37
Annin Company ..... *
Armstrong Machine Works 81
Atomics International Div. of North American Aviation ..... *

B

Babbitt Steam Specialty Co. ..... *
Babcock & Wilcox Co. 4-5
Badger Mfg. Co. ..... *
Bailey Meter Company 10-11
Baldwin-Hill Co. 24
Baltimore & Ohio Railroad 88
Barnes & Jones, Inc. 108
Basnik Co., Vince 154
Belmont Packing & Rubber Co. 132
Biddle Co., James G. 186
Bingham Pump Co. 43
Bituminous Coal Institute 16-17
Black, Sivalls & Bryson, Inc. ..... *
Blaw-Knox Company Equipment Div. ..... *
Blaw-Knox Company Power Piping Div. ..... *
Boiler Tube Co. of America 126
Bonney Forge & Tool Works ..... *
Borg-Warner Mechanical Seals Div. of Borg-Warner Corp. ..... *
Bridgeport Brass Co. 169
Buell Engineering Co. 122
Buensod-Stacey Co. ..... *
Buffalo Forge Co. 159
Buffalo Pumps, Inc. 36
Bussmann Mfg. Co. ..... *
Butler Mfg. Company ..... *

C

Carpenter Steel Co. Alloy Tube Div. ..... *
Catawissa Valve & Fittings Co. 124
Centrifix Corp. ..... *
Chase Brass & Copper Co. ..... *
Chemical & Materials Corp. ..... *
Chemtrol ..... *
Chesterton Co., A. W. 164
Childers Mfg. Co. 41
Clarage Fan Co. 107
Clark Bros. Co., One of the Dresser Industries 79
Cleaver-Brooks Co., Boiler Div. ..... *
Cochrane Corporation ..... *
Coen Company 136
Combustion Engineering, Inc. ..... *
Condenser Service & Engrg. Co. 138
Cooper-Bessemer Corp. ..... *
Copes-Vulcan Div., Blaw-Knox Company 12-13
Coppus Engineering Corp. ..... *
Corning Glass Works ..... *
Crane Company 111
Crawford Fitting Co. ..... *

D

Deady Chemical Co. ..... *
Dearborn Chemical Co. ..... *
DeLaval Steam Turbine Co. 26-27
Detroit Controls Div. of Amer. Standard 139
Detroit Stoker Co. 183
Diamond Power Specialty Corp. 6-7
Dodge Mfg. Corp. 109
Dow Chemical Co. 143
Dow Corning Corp. 173
Dowell 175
Dustex Corp. ..... *

E

Eagle-Picher Co. 179
Edward Valves, Inc. 22-23
Electrama 124
Electric Machinery Mfg. Co. ..... *
Elgin Softener Corp. 185
Elliott Company ..... *
Elliott Company—Lagonda Plant ..... *
Elliott Company—Roto Plant ..... *
Emhart Mfg. Company Maxim Div. 116
Engineer Company ..... *
Erie City Iron Works ..... *

F

Fairbanks Company ..... *
Fibreboard Paper Products Corp. Pabco Ind. Insulations Div. 96
Fisher Governor Co. 157
Flexitallic Gasket Co. 151
Fly Ash Arrestor Corp. ..... *
Foster Company, Benjamin ..... *
Foster Wheeler Corp. 14-15
Foxboro Company ..... *
Frick Company 104
Fuller Company ..... *

G

Garlock Packing Company 20-21
General Controls Corp. 119
General Electric Co. 33
Goulds Pumps, Inc. 189
Green Fuel Economizer Co. ..... *
Grinnell Company 148
Griscom-Russell Co. ..... *

H

Hagan Chemical & Controls, Inc. ..... *
Hall Laboratories 31
Hamon, Inc. ..... *
Harbison-Walker Refractories Co. ..... *
Hartman-Walsh 218
Heyl & Patterson, Inc. ..... *
Hungerford & Terry, Inc. 138

I

I-T-E Circuit Breaker Co. ..... *
Illinois Water Treatment Co. 170
Infilco Inc. 84
Ingersoll-Rand Co. 133
International Boiler Works Co. 180
International Nickel Co., Inc. 93
International Register Co. Instrument Div. ..... *
Iron Fireman Mfg. Co. 85

J

Jenkins Bros. 48-49
Jerguson Gage & Valve Co. ..... *
Johns-Manville 83
Johnson Service Co. ..... *
Jones & Laughlin Steel Corp. ..... *

K

Kato Engineering Co. 152
Keasbey & Mattison Co. 46
Keeler Co., E. ..... *
Kennedy Valve Mfg. Co. 134
Kennedy-Van Saun Mfg. & Engrg. Corp. ..... *
Kerrigan Iron Works, Inc. 128
Kieley & Mueller, Inc. ..... *
Kinney Engineers, Inc., S. P. 128
Kirk & Blum Mfg. Co. 120
Klipfel Valves, Inc. 171
Koppers Co., Inc. Coupling Dept. 141
Koppers Co., Inc. Electrostatic Precipitators 181

L

Laclede Stoker Co. ..... *
Ladish Company ..... *
Leslie Company ..... *
Limitorque Corp. 40
Link-Belt Company 1
Liquidometer Corp. 180
Lunkenheimer Co. ..... Third Cover

M

Manning, Maxwell & Moore, Inc. 193
Marley Company ..... *
Marsh Corp., Jas. P. 194
Mason-Neilan Div. of Worthington Corp. 38-39
McDonnell & Miller, Inc. 188
McGraw-Hill Book Co. 170
McNally Pittsburg Mfg. Corp. 156
Mercoid Corp. 182
Midwest Piping Co., Inc. 135
Minneapolis-Honeywell 25
Morton Salt Co. Industrial Div. ..... *
Murray Iron Works Co. 167
Murray Mfg. Co., D. J. ..... *

N

National Airoil Burner Co., Inc. 172
National Aluminate Corp. 155
National Conveyors Co., Inc. ..... *
National Electric Coil 42

This index is a service to readers. Every effort is made to maintain its accuracy, but POWER cannot assume responsibility for errors or omissions. When a star appears after the name, the advertisement does not appear in this issue but appeared in an issue within the previous three months.

National Tube Div. of U. S. Steel ..... *
Niagara Blower Co. 172
Nicholson & Co., W. H. 177
Nordberg Mfg. Co. ..... *
Norfolk & Western Railway 165

O

Ohio Brass Company 95
Orr & Sembower, Inc. ..... *

P

Panellit, Inc. ..... *
Patterson-Kelley Co. ..... *
Peabody Engrg. Corp. 130
Peerless Pump Div., Food Machy. & Chemical Corp. 228
Pennsylvania Pump & Compressor Co. 168
Pfaudler Permutit, Inc. 166
Phelps-Dodge Copper Products Corp. ..... *
Philadelphia Gear Corp. 40
Phoenix Mfg. Co. ..... *
Pioneer Service & Engineering Co. ..... *
Pipe Fabrication Institute ..... *
Pittsburgh Piping & Equipment Co. 50
Porter Co., Inc., H. K. Forge & Fittings Div. 190
Powell Co., Wm. 147
Pratt Co., Henry 184
Pritchard & Co., J. F. 94

R

R-P & C Valve Div., Amer. Chain & Cable Co., Inc. 178
Raybestos-Manhattan, Inc. Manhattan Rubber Div. ..... *
Raybestos-Manhattan, Inc. Packing Div. 176
Reliance Gauge Column Co. 92
Republic Flow Meters Co. ..... *
Republic Steel Corp. Steel & Tubes Div. 44-45
Research-Cottrell, Inc. ..... *
Ridge Tool Company 102, 103
Riley Stoker Corporation 74-75
Robertshaw-Fulton Controls Co. Aeronautical & Instrument Div. ..... *
Rockwell Mfg. Co. Nordstrom Valve Div. 105
Rohm & Haas Co. ..... *

S

Sarco Company, Inc. 28
Schaub Engrg. Co., Fred H. ..... *
Schoonmaker Co., Inc., A. G. 154
Scovill Mfg. Co. ..... *
Sheraton Corp. of America ..... *
Smith Corp., A. O. 126
Socony Mobil Oil Co. 115
Sparkler Mfg. Co. ..... *
Spence Engrg. Co. ..... *
Standard Oil Co. of Indiana 137
Stephens-Adamson Mfg. Co. 153
Stickle Steam Specialties Co. ..... *
Stow Mfg. Co. ..... *
Strong, Carlisle & Hammond 174
Superior Combustion Industries, Inc. 101

T

Taylor Instrument Companies ..... *
Terry Steam Turbine Co. 91
Texas Company 34
Titusville Iron Works Co. Div. of Struthers-Wells 35

U

Union Asbestos & Rubber Co. ..... *
Union Iron Works 158
U. S. Electrical Motors, Inc. 29
United States Gauge ..... *
United States Motors Corp. ..... *
Universal Atlas Cement Div. of U. S. Steel ..... *

V

Viking Pump Co. 152
Virginia Gear & Machine Corp. ..... *
Vogt Machine Company, Henry 163

W

W-K-M Division ACF Industries, Inc. ..... *
Wallace & Tiernan, Inc. ..... *
Walworth Company 32
Western Chemical Co. 162
Western Precipitation Corp. ..... *
Westinghouse Electric Corp. ..... *
Wheeler Mfg. Co., C. H. 191
Where to Buy 218
Whiton Machine Company ..... *
Wickes Boiler Co. ..... *
Wiedeke Co., Gustav ..... *
Wolverine Tube Div. of Calumet & Hecla, Inc. ..... *
Worthington Corp. ..... Back Cover

Y

Yarnall-Waring Company 8-9, 77, 154

Z

Zallea Brothers 117
Ziegler Co., G. S. 187

●

Professional Services 218

●

CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 218, 219

EDUCATIONAL
Books 219

EQUIPMENT
(Used or Surplus New) For Sale 219-225

WANTED
Equipment 219

ADVERTISERS INDEX

Ajax Electric Motor Company 219
Allied Electric & Machinery Company 219
American Air Compressor Corp. 220
Arg Chemical Machinery 222

Barrow, Samuel W. 224
Belyea Company, Inc. 225
Benson-Wilimzig, Inc. 225
Boston Metals Company, The 219-221-222
Brill Equipment Co. 223
Brew-Woltman & Company, Inc. 223

Campbell & Company, Ltd. C. R. 223
Chicago Electric Company 225
Coeval Inc. 218

DeRose, G. M. 225

Ebasco Services Inc. 222

Foster Company, L. B. 223

H & P Machinery Company 220
Hall & Company, Stephen 220
Heat & Power Company, Inc. 224
Hemphill & Company, J. L. 220

International Power Machinery Co. 223

Lefax Publishers 219
Lewon Brothers 220

Midwest Boiler & Turbine Co. 220

Neu Corporation, Hugo 224

O'Brien Machinery Company 222

Pelnik-Loconti Industrial Supply Co. 223
Perry Equipment Corporation 224
Power Equipment Company 225

Schoonmaker Company, Inc., A. G. 222

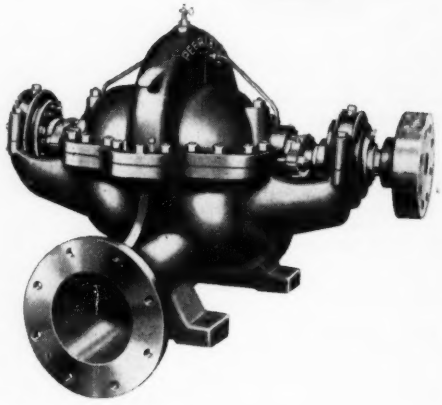
Universal Power & Engineering Co. 223
Utilities Machinery Corp. 219

Wagner Company, Arthur 220
Weaver, Inc., Charles 223
Whisler Equipment Company 225
White Fuel Corporation 222

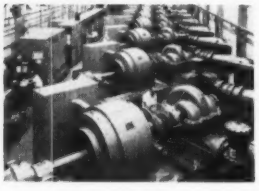
today there stands a city–

Where once, because there was no water, this farm failed. Helping supply water to municipalities everywhere are Peerless Type A centrifugal pumps. These horizontal work horses of the general purpose pumping field combine all the features necessary to outstanding, dependable pump performance. Split case design provides easy maintenance and inspection without disturbing piping. Superior hydraulic characteristics provide a capacity range of up to 70,000 gpm and a head range to 300 ft. A Type A's overall design efficiency and quality construction endow it first with a measurably longer service life and second with job versatility that qualifies it for nearly every pumping requirement your system may call for.

Get the finest–get the Peerless Type A horizontal centrifugal pump.



PEERLESS PUMPS



WRITE FOR BULLETIN NO. B-1300

Putting Ideas to Work

fmc FOOD MACHINERY AND CHEMICAL CORPORATION ®

FOOD MACHINERY AND CHEMICAL CORPORATION

Peerless Pump Division

Plants: LOS ANGELES 31, CALIFORNIA and INDIANAPOLIS 8, INDIANA

Offices: New York; Cleveland; Chicago; St. Louis; San Francisco; Atlanta; Plainview; Lubbock; Phoenix; Albuquerque; Los Angeles; Fresno. **Distributors in Principal Cities.** Consult your telephone directory.

For more facts circle 345 on Reader Service card, p 97

Maintenance–Saving Features You Can See

LUNKENHEIMER IRON BODY GATE VALVES

Machined guides . . . another Lunkenheimer exclusive, eliminate chatter and reduce wear . . . *true-solid discs* are unaffected by temperature variations . . . *Stemalloy*® *stems* assure longer stem thread life . . . *seat rings do not come loose or distort*—these are a few of the features that make Lunkenheimer Iron Body Gate Valves the most maintenance-free in the industry.

Ask your Lunkenheimer Distributor for a comparison test that will save you maintenance dollars, or write The Lunkenheimer Company, Cincinnati 14, Ohio.

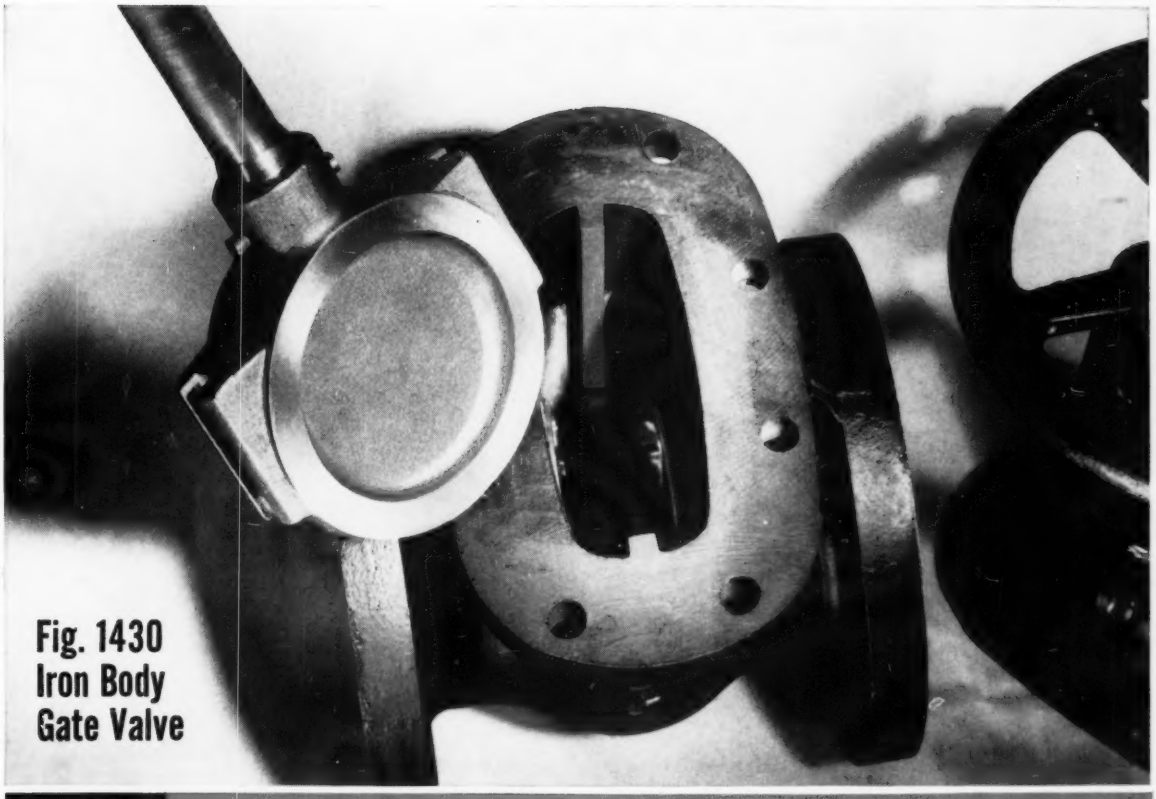


Fig. 1430
Iron Body
Gate Valve

LUNKENHEIMER QUALITY

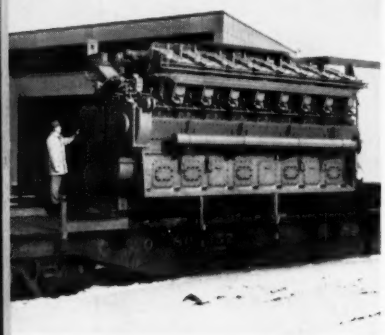
LUNKENHEIMER®
THE ONE *Great* NAME IN VALVES

ARE YOU AN ENGINE EXPERT?

An interview with William M. Kauffmann, Chief Engineer of the Engine Division, Worthington Corporation An engine is only as good as the design philosophy behind it. In this short interview, Mr. Kauffmann answers some of the questions most frequently asked him. If you would like to have more complete information about the Worthington line of engines and engine compressors, won't you write to Worthington Corporation, Section 43-6, Harrison, N. J. In Canada: Worthington (Canada) Ltd., Brantford, Ontario.

WORTHINGTON

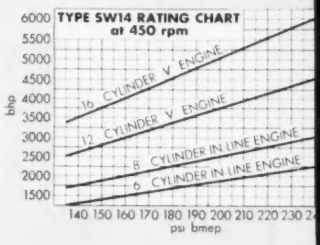
Q. WHAT SPEED RANGE SEEMS BEST FOR CONTINUOUS-SERVICE HEAVY-DUTY ENGINES OF 1500 TO 5000 HP?



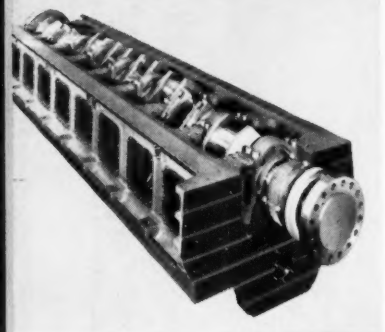
A. Our belief is engines can operate safely today at speeds in the neighborhood of 500 rpm. Shafts can be designed free of critical vibrations through all speed ranges. Of course, other advantages obtained from higher speeds are smaller and less costly generators, less required floor space.

Q. HAS THE MODERN ENGINE REACHED ITS LIMITS IN BMEP?

A. Certainly not. Our SW14 engine, while presently rated at 169 BMEP, was structurally designed for ratings in excess of 200 BMEP. Current research has shown the wisdom of our thinking since we have actually operated this engine in our Research Department at over 200 BMEP.



Q. IS THERE ANY DIFFERENCE IN ACCESSIBILITY OF ENGINES IN THE SIZES MENTIONED ABOVE?

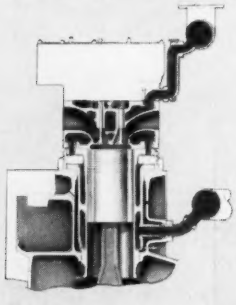


A. Yes, there is. Some engines maintain underslung crankshaft design commonly used on automotive type engines. We agree with the merits of that design on small engines which can be rolled over for access to bearings. In the larger stationary types, we believe the crankshaft should be supported in the base and accessibility to bearings provided through amply large side openings.

Q. WILL MEDIUM SPEED ENGINES BURN RESIDUAL FUEL SUCCESSFULLY?

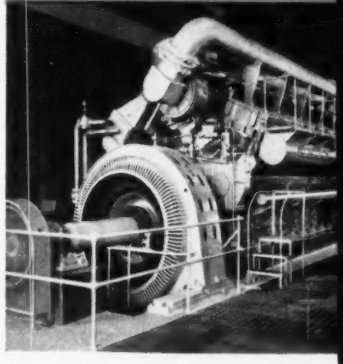
A. Field installations of these units, operating continuously on residual fuels, and reliably supplying power at lowest cost, have demonstrated that this answer is "yes." Contributing to this successful performance is the pre-injection principle patented in Worthington's dual plunger pump. More complete combustion is obtained by introducing a pilot charge ahead of the main charge.

Q. WHAT ARE ADVANTAGES OF INTEGRAL CYLINDER JACKET CONSTRUCTION?



A. The major advantage is simply this: conventional design using wet sleeve liners and sealing rings may be subject to possible leakage of cooling water into the crankcase. The one-piece liner and jacket construction eliminates this problem. In addition, this type of construction provides for more efficient cooling by means of the annular water space. As such, it is particularly adaptable for high temperature cooling.

Q. WHAT OTHER TYPES OF FUELS CAN BE UTILIZED?



A. Modern turbocharged engines designed in accordance with Worthington's tri-power principle readily operate as dual fuel, spark ignition or oil diesel—with no change of compression ratio or major engine components. Experience with almost 2-million installed horsepower of all of these combinations in successful operation, provides us with a generous background for future progress in the field of fuel utilization.

For more facts circle 203 on Reader Service card, p 97